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The first issue of				1888 cont'ined	175	different	adv'ts.
1881 contained	28	different	adv'ts.	1889 "	234	"	"
1882 "	45	"	"	1890 "	289	"	"
1883 "	63	"	"	1891 "	325	"	"
1884 "	82	"	"	1892 "	316	"	"
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International Electrical Congresses. THE Chamber of Delegates of the World's Fair International Electrical Congress was the third body of the kind at which different countries were represented by official delegates, the other two being those that met at Paris in 1881 and 1884. While it is extremely desirable that the great exhibitions held in various parts of the world at intervals of several years shall continue to serve as occasions for international professional meetings, it is not so desirable that the result of the discussions shall partake of an official character from the presence of official delegates. Injudicious measures from hasty action in regard to new units or changes in those already established might easily do much harm, and at any rate lessen the great weight of authority that should attach to such an official body. As a consequence, it is to be regretted that the Chamber of Delegates at Chicago did not take some action with a view to limiting the appointment of official representatives at too frequent intervals. A statement from this body to the effect that an interval of a certain period—say, ten years—should intervene would probably have prevailed in the future, and removed a real cause of uneasiness as to the stability of electrical units.

The Proposed Unit of Light. THE unit of light proposed by Prof. S. P. Thompson in a paper read before the International Electrical Congress at Chicago, which we reprint in another column, has several points in its favor, but there are nevertheless objections to it which the author himself refers to in the paper. The new unit is based upon the interesting principle that with a given carbon the light emitted from the crater of the positive carbon is uniform in intensity. Being dependent upon the temperature of volatilization of the carbon alone, it is not influenced by the voltage, current or length of arc, and the total light emitted from a given area is therefore constant. Unfortunately, however, the temperature of volatilization and consequently the intensity of the light varies with the quality of the carbon. In addition, the diaphragm necessary to be interposed to shut off all light except that from the central part of the crater introduces another error which Prof. Thompson states is by no means negligible. The practical difficulties to the utilization of this system are considerable also, but doubtless less so than with the entirely impracticable Violle standard. Should the objections referred to be practically overcome, the standard proposed will almost certainly receive serious consideration at a future congress.

The Candle Power of Arc Lamps. THE conclusions in the paper by Prof. Carhart, in another column, as to the dependence of the candle power of an arc lamp on the watts supplied to it, rests upon assumptions that are far from correct. Measurements were made of an arc light at different voltages and currents at an angle of 45 degrees in each case, and it was found that there was a wide variation in the candle powers at this angle with the watts. That there should be such a variation, independently of any assumption in regard to the watts, was to be expected, but it does not follow by any means that the same variation would hold if the mean spherical candle power had been obtained and compared in the same manner. That the intensity of the ray of light at an angle of 45 degrees with one current is comparable with the intensity at the same angle with another current can only be true on the supposition that the distribution of light in the second case is exactly similar to that of the first, or that the ray at 45 degrees in all the cases varies directly with the mean spherical candle power. In curves of measurements of the spherical candle power the maximum ray has been shown to vary widely in angular position. As a given ray depends for its angular position on the relative position of the carbons and the form of the crater, it is far from correct to assume that with different currents a ray at an angle of 45 per cent may be taken as proportional to the mean or effective candle power of an arc, and, as a consequence, the conclusions arrived at are open to grave objections.

The Business Situation. THE turn business affairs have taken since the first of the month is not only encouraging but furnishes an assurance that the period of depression has now been fairly passed. On every hand are reports of closed factories reopening, and a daily contemporary states that a careful survey shows that in the last ten days at least one-half of the men thrown out of employment have been taken on again. A gratifying lesson taught by the financial flurry is the stability of electrical industries. While there have been several failures and the General Electric Company has suffered severely in the stock market, yet electrical interests have stood the trial better than perhaps any other branch of business. As an indication of this we may mention that the advertising patronage of THE ELECTRICAL WORLD actually increased during the month of July, and also during the month of August, as compared with the corresponding months of last year. In a new industry that has developed as rapidly as that relating to electricity this was scarcely to be expected, and furnishes a good omen for the future. One cause has undoubtedly been the forbearance shown by creditors in not mercilessly pressing their claims, which is another indication of the fraternal feeling so often remarked as existing in the electrical field. Now that we are entering on a new era of prosperity it is to be sincerely hoped that the few who succumbed to the force of circumstances will soon be on their feet again, rejuvenated by the trials through which they have passed.

Empiricism. THE paper read by Prof. Crocker before the International Electrical Congress at Chicago, on direct current dynamos of high potential, besides being of great intrinsic interest, teaches incidentally the danger of dogmatizing upon technical matters without a real basis in fact. For many years the rule was laid down that the difference of potential between adjacent bars of commutators should not exceed 9 volts, yet Prof. Crocker describes two machines which worked successfully, one with a difference of 100 volts and the other with 150 volts. While the successful working of these machines was partly due to the use of carbon brushes and perhaps partly to the fact that they were motor dynamos in which it may be possible the mutual action of the two circuits tends to reduce sparking, nevertheless the arbitrary dictum in regard to the limiting potential between the bars of commutator has been definitely disposed of and the way thus opened for a new advance. All doubtless remember Edison's remark in his testimony in the incandescent lamp case, to the effect that he did not want to know Ohm's law, as that knowledge might hamper him in his experimental work. It is probable that Mr. Edison did not intend the statement to be accepted literally, but as an extreme illustration of the danger to an investigator of confiding in rules and limitations which, if accepted unquestioned, would effectually check all progress. The engineering branches of science are particularly fertile in such empirical rules, and while they often prove useful guides for workshop practice, they should nevertheless be regarded in their proper character as safeguards for the timid and unambitious and otherwise considered as direct hindrances for the truly ambitious. The spirit of the age is against accepting anything on mere dicta, and while authority deserves the most respectful consideration it should be remembered that almost every great advance made in the world has been in direct opposition to the opinion of authority. As to formulas and thumb rules in general, a good line of action would be to consider them wrong until it has been determined that they really rest upon rational principles. Even if they give good practical results they should nevertheless be regarded in another sense as make-shifts and as fetters to true progress, and only to be implicitly accepted between the limits within which they have practically proved to be correct.

Institute of Electrical Engineers' Branches. THE subject of local branch meetings of the American Institute of Electrical Engineers has again been taken up, and, it is needless to remark, all of the points bearing on it should be most carefully considered before any conclusion is arrived at. If the local branches are merely intended as social centres and for the discussion of papers read before the main body of the Institute, there can be no objection, but on the contrary a good end will be accomplished by their establishment. If, on the other hand, each local branch is to be in a sense autonomous the effect will undoubtedly be to weaken the Institute, not only in its professional standing, but also as a body. At present papers are too often read that are inappropriate from their character or lack of importance, notwithstanding the knowledged competency of the Committee on Papers. This is a charge that can be brought against every professional society, and the Institute has sinned less in this respect than perhaps some of its older brethren. If, however, local bodies of a few score of members are to add their papers to the *Transactions*, or publish them under the name of the Institute, the result will inevitably be disastrous. If it is not an easy matter to procure sufficient material for creditable papers from a body of over seven hundred members, what will be their general character if this number is narrowed to a few score or hundred? Should local bodies be established with no restriction in this respect, local pride will require papers to be read; and as it is not probable that the supply of really valuable material will thereby be considerably increased, the result will often be the preparation of papers whose only excuse is that the programme requires that one shall be read. To exclude papers read at the branches from the *Transactions*, or to select certain ones for inclusion, will not solve the difficulty. In the latter case, local pressure will be brought to bear, whereas now, as a rule, a paper is tendered on its merits, and with a consciousness that a high degree of merit is necessary. If a paper from Chicago is accepted, San Francisco or Oshkosh will next press their claims to be represented, perhaps on the question of locality alone. If branch papers are entirely excluded from the *Transactions* but otherwise permitted to be published by the branch or offered for publication, the influence on the standing of the institute will suffer from having its name connected with papers below the standard, as many of them would almost necessarily be. Another and perhaps the worst effect would be the depletion of material really valuable for the *Transactions* of the main body. This would either occur directly through local pride predominating or through the waste of material by premature or hasty preparation for local meetings. Another point to be borne in mind is that the Institute is not the only channel for the publication of the class of papers that add most largely to the value of the *Transactions*. Any deterioriation in the latter would consequently divert papers of higher character to the publications of other technical or scientific societies, or to the special scientific periodical publications whose number is yearly increasing. Other objections might be urged, for example, the disintegrating effect on the Institute as a body, so that it will be a matter of no little difficulty to arrive at a satisfactory conclusion. One solution would be to permit the formation of branches for social reunion and for the discussion of papers read as at present before the main body of the Institute. The reading of informal papers would, of course, not need to be prohibited provided that it was distinctly understood that they were not to be published in any manner that would identify them with the Institute. This latter provision may seem harsh, but if the usefulness of a great professional body is at stake the restriction is abundantly justified.

Alternating Current Motors.

To the Editor of The Electrical World:

It would save a vast amount of time, now wasted in discussion, if disputants would begin by assuming that the other side knows something and is not entirely devoid of common sense. Probably this, however, is too much to expect of academic gentlemen when the people on the other side happen to be mere engineers. As a case in point, take Dr. Louis Duncan's address at the Chicago Congress. He tells his audience that it is questionable if, in the alternating current motor built by the Stanley Electric Manufacturing Company, any advantage is gained from the short-circuited coils used to neutralize the self-induction of the armature, as these coils displace so much valuable iron. Now it so happens, and any common man would have assumed as much, that at first we tried to build the motors without compensating coils, and the results were so unsatisfactory that we were driven to use them. We know, as well as practical men can know anything, that these coils are of enormous advantage.

John F. Kelly.

The Westinghouse Charges.

The trial of Morris W. Mead, of Pittsburgh; Wm. J. Clark, of Boston, and M. H. Hamilton, of New York, on a charge of conspiring to cheat and defraud the Westinghouse Electric and Manufacturing Company of certain letters, writing, tracings, etc., was begun at Pittsburgh on September 4.

H. F. Ashton, a draughtsman formerly employed at the Westinghouse works, testified that he was engaged by Morris W. Mead and Wm. J. Clark on Sept. 1, 1892, to procure information for them from the Westinghouse works. Some time in October he met these men in Youngstown, O., and gave them some duplicates of original drawings of the Westinghouse company, and had previously given them 16 drawings. Clark, he said, asked him to get all the information he could from the Westinghouse company, and Mead told him to get the new ideas that the said company was working on. Mead paid the expense of the trip, gave him $100, and told him that he had been placed on the pay roll for $150 per month. In all he received $2,000 and expenses at various times and Mead received $25 per month. The witness testified that he met Mead nearly every night in Pittsburgh, and that he went to New York to meet Clark who paid his expenses and told him to get all of the blue prints he could from the Westinghouse company. He saw Clark again at Thanksgiving, and at another meeting met Clark and Mead at the Belvidere House, where he gave them some blue prints, estimates and prices; that night he went to Boston with Clark and Mead to see Mr. Rice and Mr. Fish about a pump. Clark informed him that what he said to Hamilton was all right, and that the latter on several occasions made short hand notes of information. He saw Clark, Mead and Hamilton again and gave what information he had obtained from the Westinghouse company in regard to prices of labor, material, etc., in certain contracts, and got possession of a stoppered lamp at Mead's suggestion. He went to Lynn and saw Mr. Rice, who showed him blue prints that had been delivered by witness to Clark, asked information in regard to the construction of certain machinery, and said that his company was at work tearing apart a Westinghouse motor to get at the cost. The witness said he secured and sent to Clark blue prints of the Niagara Falls plans. On Feb. 8 he saw Hamilton at the Monongahela House; Hamilton left there next day and registered at the Newell House under the name of Hopkins. The meeting was arranged by Mead, and he saw Hamilton nearly every day for a week and gave him information and blue prints. The witness identified a cipher code and 24 letters and 13 telegrams that had passed between himself, Clark, Mead and Hamilton in regard to information asked or sent. Among a number of blue prints and photographs the witness identified some relating to the World's Fair and Sacramento jobs and a noiseless motor, but it was shown that these were obtained from a draughtsman named Walters, who testified that they were lent to Ashton to show what kind of work he could do with a view of getting a situation with the General Electric Company.

Frank Carey testified that he had given to Ashton or to Mead blue prints of the World's Fair job.

Christian testified that he had met Mead in Ashton's room in February and gave him blue prints.

The counsel for the defense admitted the conferences, but stated that they were for an entirely different purpose than alleged, as would be shown. It was intimated that Ashton was employed by the Westinghouse company to induce the defendants to enter into a conspiracy in order to afford opportunity for a suit. A large number of letters was produced by the defense to show that they were trying to get information concerning alleged violations by the Westinghouse company of the Sawyer-Man incandescent lamp injunction.

The cross-examination was directed to show that Ashton was really in a conspiracy with the Westinghouse company against the General Electric Company, and that he had admitted to the defendants that the former company had ceased experimental work and acknowledged they had means to obtain all necessary information in regard to their competitor's work. Although Ashton, on the cross-examination, supported his direct testimony, his manner created an unfavorable impression.

Wm. J. Clark testified that on March 4, 1894, he had received information in regard to the stopper lamp, and that he met Mead and asked him to obtain information in regard to that, assist him to trace the theft of a pump design from the General Electric Company and to discover if the Westinghouse was using an Edison device in the Pleasant Valley plant. Ashton told him that Westinghouse said he would make no more experiments as they were in a position to duplicate anything that came out, and he wanted him to find out by what means this was done as far as related to his company. The different conferences were, first, to find about the theft of blue prints; second, in regard to infringements of Edison patents; third, about the Monohan pump; fourth, in regard to malicious injury to General Electric apparatus, and, fifth, in regard to the Vogel lamp. The witness stated that he finally became suspicious about Ashton.

A number of witnesses testified to Ashton's bad character and several men of public prominence from Connecticut testified in high terms to the excellent character of Mr. Clark.

The judge charged the jury to the effect that Ashton's testimony was of no value if not corroborated.

The jury went out at 10 o'clock on Friday, Sept. 8, and at 10 o'clock the next morning were discharged upon reporting that they could not agree. It is understood that the ballots stood six for conviction and six for acquittal.

Ashton has been arrested and will be tried on the charge of stealing blue prints, tracings, etc., from the Westinghouse company. Christian and Carey pleaded guilty of theft from the Westinghouse company and will be sentenced.

Considerable surprise was created that Mead and Hamilton were not called as witnesses by the defense. Although the jury apparently disagreed because of lack of corroboration of Ashton's testimony, the result of the trial is considered favorable for the defense, as it now has possession of the main points of the prosecution.

Meeting of Chicago Members of the American Institute of Electrical Engineers.

An informal meeting of members of the American Institute of Electrical Engineers resident in Chicago and vicinity was held Saturday evening, Sept. 2, at the rooms of the Institute in the Electricity Building at the World's Fair. Several other members were present upon invitation, including W. H. Preece, president of the British Institution of Electrical Engineers; George M. Phelps, Dr. N. S. Keith, of San Francisco, and Townsend Wolcott, of Hoosick Falls, N. Y. Secretary Pope called the meeting to order and stated its object to be a simple conference in regard to the desirability of holding occasional meetings in Chicago in order that the 40 members in the city and vicinity might enjoy more of the privileges of the association. He said that this question had been under consideration by the council at different times during the last two years, but that, in the absence of any united expression of opinion on the part of those most directly interested, nothing could be done. He had therefore made the call with the consent of President Houston, and suggested that the meeting proceed to organize by electing a chairman. Edward Caldwell was thereupon elected chairman of the meeting and H. A. Foster, secretary.

Mr. Pope announced that during the last year an offer had been made by the Armour Institute, Chicago, to place at the disposal of the American Institute of Electrical Engineers a suitable room or hall for meeting purposes. At his request Mr. Foster had visited the Armour Institute buildings in company with Prof. Stine, and had reported that the rooms available were suitable in every way.

Prof. Stine said there were two suitable rooms at the Armour Institute that could be used, in either of which all kinds of apparatus were available for experimental purposes, and both alternating and continuous current could be had. There was also a hall seating 2,000, which might be desirable for public lectures. A valuable library was being secured, and technical journals would be found on file.

Dr. Keith said there was now in San Francisco a flourishing electrical society having about 100 members and holding semi-monthly meetings, and that the matter of affiliating this society with the Institute had been considered in San Francisco; the sentiment was favorable, but formal action had been deferred until the opinion of the Institute had been obtained. He considered that the establishment of branches would result in a largely increased membership of the Institute and an increase in the number and value of its papers.

Lieutenant Rodman expressed himself heartily in favor of such a movement as is contemplated, and believed that it would bring about good results.

Clark C. Haskins thought that the proposed plan would evade most of the difficulties which had been encountered in placing local societies on a substantial footing on account of the closer affiliation with an organized national society.

Mr. W. H. Preece referred to the several great English societies, and said that the meetings were not considered of as much value to the members as the published transactions. He advised that every effort should be made to increase the membership without lowering the standard, and that the larger possible proportion of the income should be devoted to printing. By the proper selection of papers to be read he believed the proposed movement would be productive of much good.

After further remarks by Messrs. Arnold, Phelps, Pierce, Wolcott and others, the chairman appointed Messrs. H. A. Foster, B. J. Arnold and R. H. Pierce a committee to canvass Chicago members to ascertain if they were desirous of having Institute meetings held as proposed.

Street Railway Motor Rheostats as Car Heaters.

BY WALTER E. HARRINGTON.

Below are given the results of some experiments to determine if the rheostats used in connection with electric street car motors would develop enough heat to either warm a car alone or contribute largely to that result. The idea in view was to introduce properly designed rheostats under the seats of the cars to utilize the heat now dissipated and lost underneath the car, as is at present the case with systems using the rheostatic method of regulation. The windows and doors of a car standing in a car house were closed and a thermometer placed in the car, and one outside. The car rheostat was fixed within the car, and resistance connected in series, and by working a switch the current variations were made as nearly as possible like those that occur when a car is in regular service. A motorman handled the switch and worked it once a minute for five hours, with the following tabulated results:

Time.	Temperature inside car in F.	Temperature outside car in F.	Difference.
7 A. M.	72	71	+ 1°
8 "	82	72	10°
9 "	84	75	11°
10 "	89	78	11°
10.50 "	91	79	12°
12.00 M	94	82	12°

The car was then run a forenoon behind a regular car in service, and thus under the same conditions as in service, with the one exception that the doors were not opened, and therefore no heat could escape from that reason. The results of that test are herewith tabulated:

Direction of run.	Time.	Temperature inside car in F.	Temperature outside car in F.	Difference.
Down	9 A. M.	76°	76°	0°
Up.....	9.20 "	81°	78°	3°
Down	10.20 "	89°	83°	6°
Up.....	11 "	92°	85°	7°
Down	11.45 "	94°	89°	5°
Up.....	12.20 "	95°	88°	7°

The above results were considered too low to warrant the expense of preparing special rheostats. The results, though, are exceedingly interesting, as the equipment is one 25-h. p. motor to a car and the regulation entirely rheostatic; that is, the motor windings do not undergo any changes of any character. The apparent loss by this method of regulation, as is represented in the heat loss or radiation of car rheostat, is exceedingly small, thereby bearing out the argument of those railway men who have been in favor of rheostatic regulation in preference to the more cumbersome and complicated commutation methods.

High Speed Electric Railway from Brussels to Antwerp.

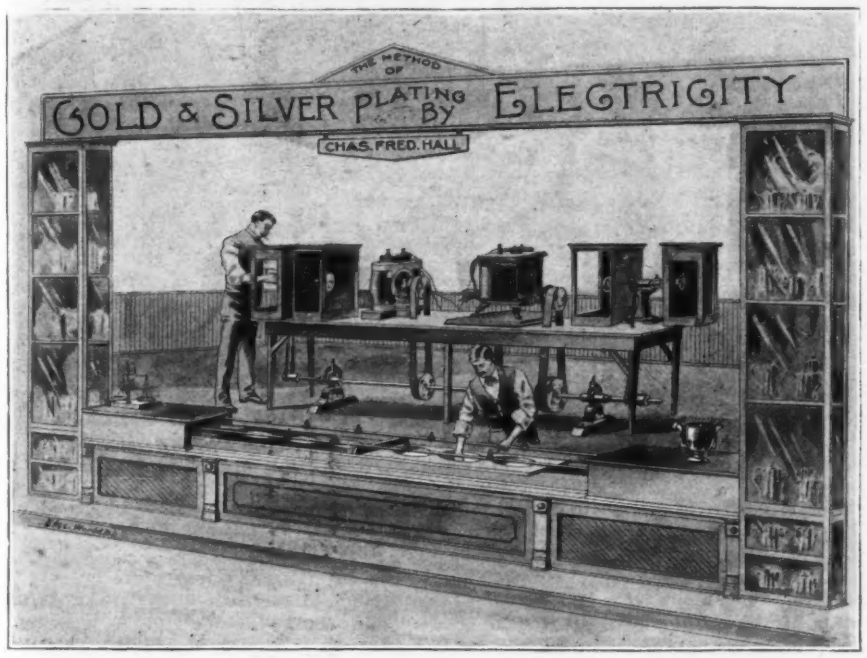
A very interesting high speed electric railway has been proposed to run between the cities of Brussels and Antwerp. The total distance is about 24.8 miles; it is intended to connect the international exhibitions which are to be held simultaneously in the cities of Brussels and Antwerp in the year 1895, and is afterward to be changed into a permanent road; the route is an almost straight line between the two cities; the speed is to be 112 miles per hour; there is to be a train in each direction every fifteen minutes, and the time of a trip will be twenty minutes; a train is to consist of two cars in which the seats are to be longitudinal, as in American horse cars, in order that in case of derailment "passengers will suffer less from the shock;" the promoter, Mr. Flamache, states that in view of the stability of rapidly revolving wheels, as, for instance, in a bicycle, it is not certain that the danger increases with velocity; the cost is estimated at 18,000,000 francs, of which 4,000,000 could be saved if it were not necessary to cross a river at a height of 66 feet, to permit vessels to pass beneath, and if instead of such a bridge a swinging pivot bridge be used: it is proposed to build the road next spring, and by employing sufficient workmen it is believed to be possible to finish it before the opening of the exhibitions.

IN ELECTRICITY BUILDING AT THE WORLD'S FAIR

Elec World N.Y. R.J. Outcault

GOLD AND SILVER PLATING BY ELECTRICITY.

There are few housewives who do not know the inestimable value of electricity for gold and silver plating. It is one of the oldest practical applications of the electric current, and yet the exhibit made by Mr. Chas. F. Hall in the gallery of Electricity Building has attracted as much, if not more, attention than any other display in the entire upper floor.



GOLD AND SILVER PLATING BY ELECTRICITY.

Mr. Hall enjoys the only privilege granted by the Exposition authorities for doing work of this kind, and there are scores of visitors to the Fair who appreciate the wisdom of the concession. From the very opening of the Fair this display has attracted large crowds eager to have small articles of jewelry, souvenir coins and other things gold or silver plated, the operation being performed before them. It is difficult to get any idea of the amount of work Mr. Hall has done since the opening day; but if one is to judge from the number of gold-plated badges worn in all sections of the ground, all the work of this enterprising young man, he would be inclined to think that Mr. Hall enjoyed one of the most valuable franchises on the grounds.

As shown by the illustration, the apparatus is admirably displayed for educational purposes, and this, combined with the operations actually performed before the eyes of the visitors, makes the exhibit a model one of a kind that has been grossly neglected at the World's Fair.

THE JENNEY ELECTRIC MOTOR COMPANY.

In observing the interesting features of Electricity Building, it is curious to note with what care and taste the ground floor space has been laid out. The more imposing exhibits are artistically grouped in the centre, while the more compact and unique are stowed away along the side walls, beneath stairways, or in some quiet corner.

Whether by accident or design, the location of the Jenney Electric Motor Company is certainly one of the most prominent of any on the ground floor. It is situated immediately beneath the stairway leading to the southwest gallery of the building, and consequently enjoys the advantage of being near the main entrance. The first thing about the display to command attention is the office. This is a cozy little structure finished in bronze, and very effectively lighted by incandescent lamps. It reaches from the ground to the stair support, and contains within desk and chairs for the attendants. Immediately over the little door the word "Jenney" is continuously twinkling through crystal glass, the effect being produced by small incandescent lamps so connected that first one letter, then another and another, is switched on until the whole word stands out.

The history of this well known firm is most eloquently expressed in the two dates emblazoned on either side of the illuminated sign—"1878—1893." There is nothing more about the entire display to tell the story of those years, except the fine exhibit of their apparatus.

The exhibit of apparatus includes a complete line of direct current electrical machinery, embracing direct current transformers, electric light and power and electroplating generators, and automatic electric motors and motor starters.

The current used in this display is supplied from a Jenney 40-kw., 500-volt compound generator in Machinery Hall. This current is first led to the 25-h. p. and 35-h. p. motors, which motors are coupled direct to generators of the 110-volt compound wound type. The current is taken from the generators to two sets of bus wires on the switchboard, and there by means of double throw switches is supplied to arc and incandescent lights and motors, 5 h. p. also being furnished to a neighboring exhibit, that of the Hanson & Van Winkle Company.

The dynamo exhibit includes a 40-kw., 500-volt generator; 30-kw., 20-kw. and 3-kw. 110-volt generators, and a 300-ampere 5-volt electric plater. In addition to the 35 and 25-h. p. motors already mentioned, there are running from the 110-volt generator one each of 12-h. p., 6-h. p. and 1½-h. p. motors. The 6-h. p. is running a 24-ampere dynamo, and the ½-h. p. motor is coupled direct to a flexible shaft used in buffing, drilling and general machine shop work.

The motor starters embody some new and novel ideas, being considered most reliable and satisfactory devices. On a magnet is a coil in series with the field of the motor, and until the main line switch is closed it is impossible to cut out the resistance or start the motor, as the armature of the magnet is held below, and acts as a brake to the resistance arm. The moment the switch is closed the armature is drawn up, which will then allow the motor to be started by cutting out the resistance with the contact arm. After the resistance is out or the motor running at full speed the arm is held in place by a small lever. In case the current is suddenly or accidentally broken the armature immediately drops, allowing the arm to return to its starting position, thus saving the motor when the current is again on. This very clever device has attracted no end of attention.

The switchboard is complete in every form, it being a polished oak frame with marble panels and trimmings of polished brass. The special pains which have been taken to make this a model board, both in design and workmanship, have been highly successful. There are two sets of bus wires, one set for each dynamo, or one for the dynamo and the other to be connected to the street mains, and by use of the double throw switches the load can be changed from one machine to the other. In case of a sudden breakdown, the street circuit can be instantly thrown in, thus avoiding total darkness.

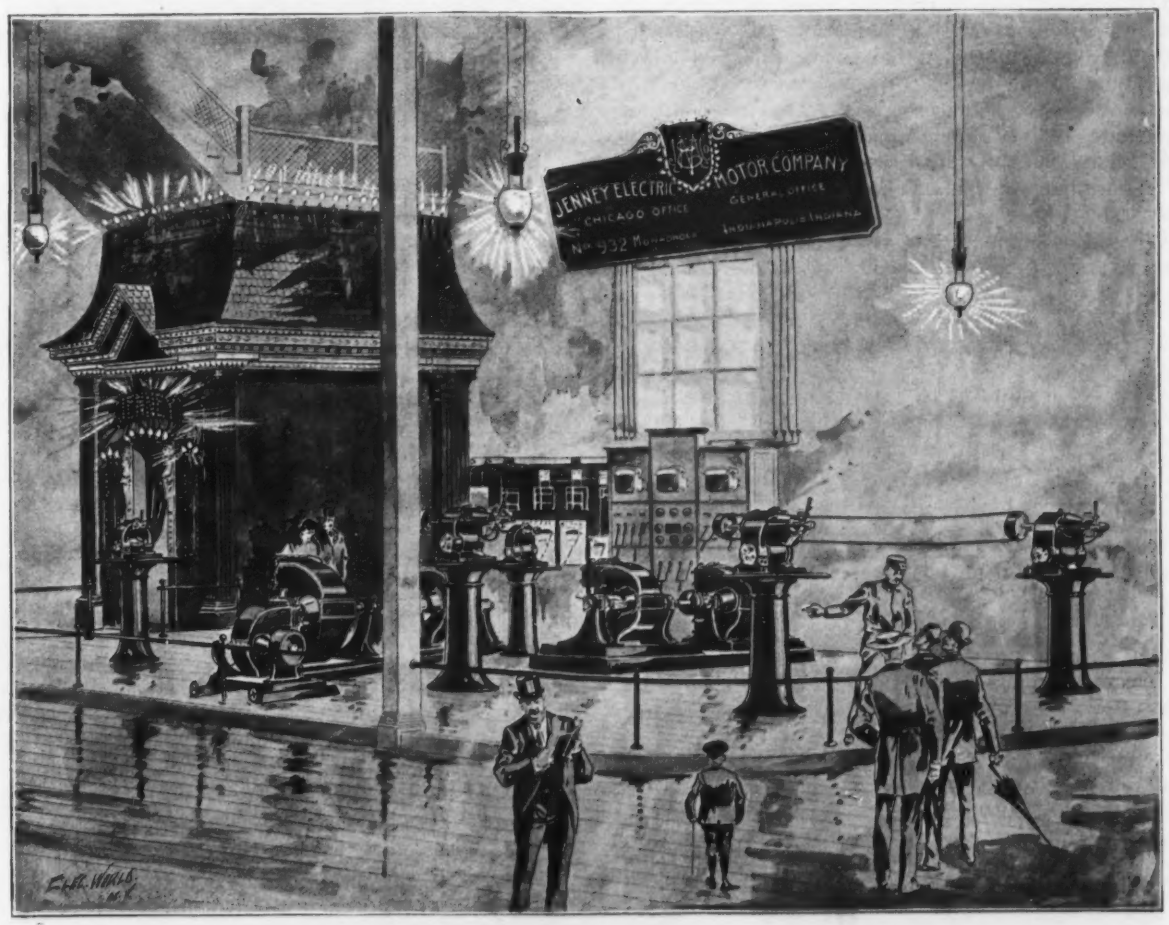
The instruments used are of the best makes. There is one ammeter for each machine or main circuit, and by means of a sliding contact switch the same voltmeter can be used for each machine or circuit.

From the main bus wires the current is taken through the switches to a smaller set of bus wires, to which are connected the circuits for lights, and they are controlled one at a time by means of small switches, or all at one time by means of the main switch. The field controllers or rheostats are set back of the board and are regulated from the front by a small hand wheel. A ground detector completes the complement of instruments.

The pavilion, to which reference has already been made, has been greatly sought after by parties desiring a moment's rest. The interior is made to represent ivory with trimmings of gold, while incandescent lights around the ceiling give it a very pretty effect. The furnishings are particularly attractive, and have been highly complimented.

THE JEWELL BELTING DISPLAY.

History seems to be a favorite theme among exhibitors in all departments of the Fair. In nearly every instance where a company can boast of an interesting story of development, no effort is spared to bring the facts to the attention of visitors. In many instances this is accomplished by printed matter, souvenirs and the like, while in other cases historic pieces of apparatus are utilized to tell the story, and it can readily be seen how effective this method is.

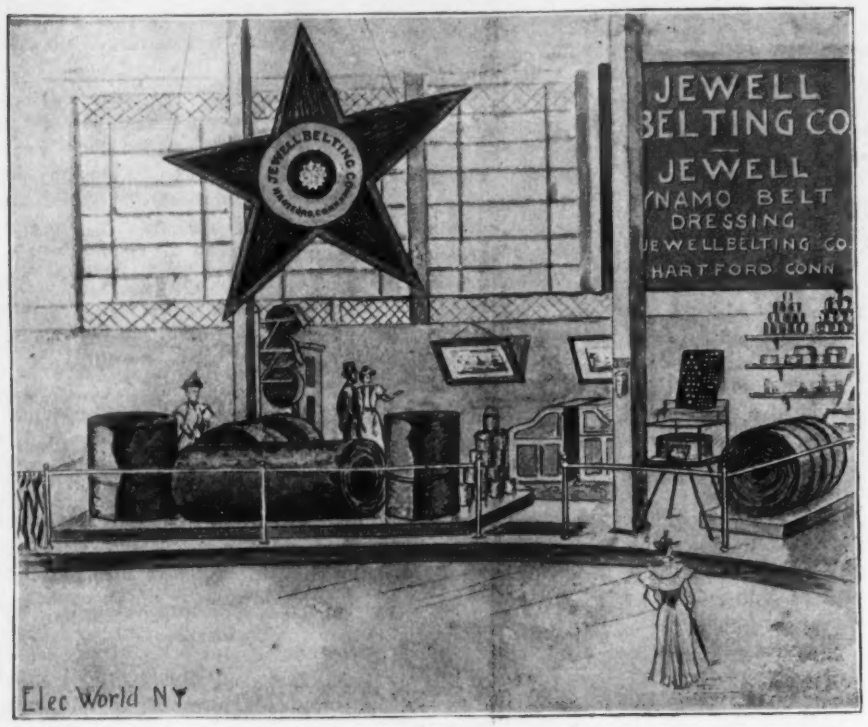


THE DISPLAY OF THE JENNEY ELECTRIC MOTOR COMPANY.

Carefully coiled in a glass case in the handsome display of the Jewell Belting Company, of Hartford, Conn., is a piece of leather belting that is said to enjoy the distinction of having been the longest in service of any belt ever constructed. It has been in constant use

at the factory of Wm. Boardman & Son, in Hartford, for 36 years, and is estimated to have traveled enough to have gone around the world nearly 3,000 times. It was in service up to the day of being taken off the pulley to be shipped to Chicago for exhibition. A careful examination of the belt shows that it is still in excellent condition, and it is claimed that if required it could repeat its past performance.

After seeing this piece of belting, the visitor is impelled to make a close examination of the display of this company. It is located in the northeast ground space of Electricity Building, and is quite unique in design.

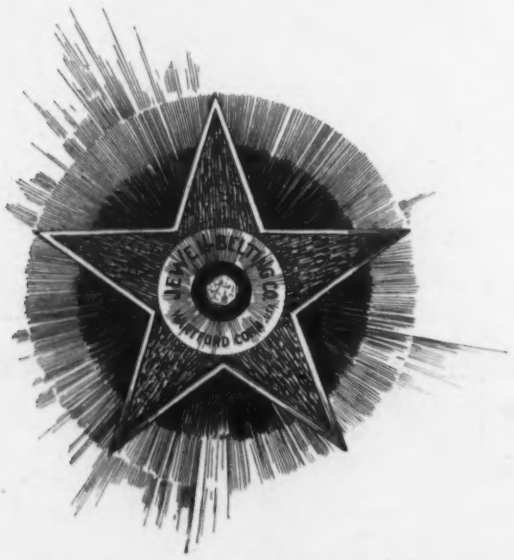


A FINE COLLECTION OF BELTS.

The first thing to attract attention is the immense star hung about 15 feet from the floor, as will be noticed in the sketch. This star is made of a framework of "Jewell" belting, each section being put together after one of the methods of manufacturing adopted by the company; that is, one section is riveted, another stapled, still another laced, and so on. The face of the star points is filled with pieces of oak bark brought from the tanneries of the company located in the far South. In the centre of the star is a huge cut-glass diamond lighted with incandescent lamps, the whole effect being that of a brilliant jewel, the trade mark of this well-known belt.

The exhibit itself is well arranged to illustrate the different styles of belting manufactured by this firm. The large belt shown in the illustration is 52 inches wide, and is the largest belt manufactured, in which the width of the belt is represented by the width of a steer hide. The total length is 95 feet. It is seldom that a belt is made in this manner. Other belts of the same character, but of smaller dimensions, are also exhibited.

A brand of belt that has attracted much attention is that known as the "Diamond." It is tanned by the pure oak process, and is short-lapped. This, as well as the other kinds, has been extensively adopted in electric stations throughout the country, and on the walls of the company's space are a number of views of stations in which the "Jewell" belting is used.



A FEATURE OF THE JEWELL DISPLAY.

In addition to the display just described, the Jewell company has operating in Machinery Hall, in connection with the Eddy power exhibit, four 24-inch dynamo belts that has given the most perfect satisfaction since the time of starting. It might be remarked here that the belts in use in Machinery Hall have been subjected to the severest tests. In fact, two of these, by reason of accident to line, short circuit, etc., have been compelled to stand a strain of more than 500 h. p., their rated capacity being but 250 h. p. each, and without the slightest injury to the belts. The company has besides a 72-inch 3-ply belt, which is running on an Atlas engine and Westinghouse dynamo in the power plant, and this belt, notwithtanding the fact that the pulleys are not and never have been in line, has given most excellent results though at times under great difficulties and strain.

THE ZUCKER & L'VETT DISPLAY.

In the line of electroplating exhibits, Electricity Building is well supplied. There are three or four in different sections of the building, one of the most interesting of which is that of the Zucker & Levett Company, of 10, 12 and 14 Grand street, New York City. This firm started the manufacture and supply of electroplating apparatus as long ago as 1863, and is now one of the largest houses in this field of work. The chemical factory of the company is at Flushing, L. I., and is said to be one of the most extensive in the world for the manufacture of nickelplating outfits. The electrical works are at 8, 10, 12 and 14 Grand street, New York.

The exhibit, of which our artist gives us a view, is situated beneath the northeast gallery stairs, and the space is admirably suited for the purpose. In addition to being easy of access from that section of the building, a first-class view of the display may be obtained from the stair landing.

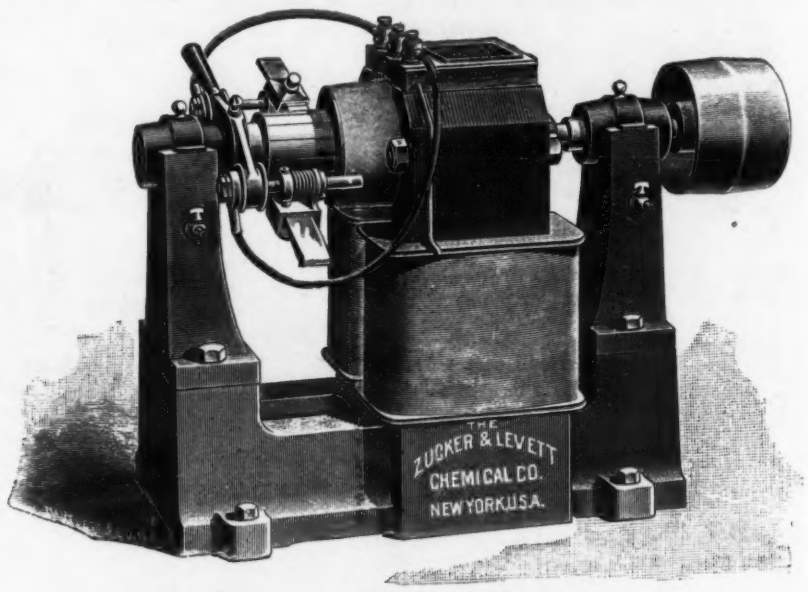
THE ZUCKER AND LEVETT CHEMICAL CO
NICKEL PLATING OUTFITS
THE ZUCKER & LEVETT CHEMICAL CO
NEW YORK & CHICAGO
COMPLETE PLATING OUTFITS
BUFFING & POLISHING MATERIALS
ELECTRIC LIGHTING POWER & PLATING
DYNAMO MACHINES for ELECTRO-PLATING & ELECTROTYPING
POLISHING MATERIALS
ELECTRO PLATING SOLUTION
Elec. World N.Y.

THE EXHIBIT OF THE ZUCKER & LEVETT CHEMICAL COMPANY.

More than half the space is devoted to the principal product of this house—electroplating supplies, including a very complete line of chemicals, buffing wheels, scratch brushes, nickel anodes and salts, polishing compositions, rouges, cleaning compounds, lacquers, plating solutions, etc. Several plating tanks, filled with plating solution, and connected to the dynamos ready for service, give the exhibit a practical aspect. Although they have no concession for doing this kind of work, as in other instances on the grounds, they have at different times given exhibitions of the excellent work they are capable of turning out.

That part of the exhibit devoted to dynamos and motors is of perhaps more interest to our readers than the section we have described. The elements of electroplating and electroplating apparatus are generally understood; but we believe the main features of the new dynamos and motors manufactured by this firm are somewhat new. In the centre of the exhibit, as will be seen from the sketch, is a 25-h. p. Hercules motor and a 200-light Hercules dynamo, while strung along on the left are a number of both dynamos and motors, of various capacities. A better view of this type of machine is given in a separate cut.

The dynamo is of the inverted horseshoe type, in which the whole of the magnetic circuit is stamped out of one sheet of Swedish iron. The field coils are separately wound on brass spools, and the distance between the magnet coils is slightly larger than twice the depth of one coil, thus allowing the same to be slipped over the core. The plate of the armature has teeth forming longitudinal channels in its periphery in which the coils are wound. These teeth, besides reducing the magnetic resistance of the air space to a minimum, entirely prevent the coils from flying out from centrifugal force. The magnet frame is bolted to an iron base having iron standards and self-oiling bearings, even in the smallest size of machines. It will be seen that by this method of construction a very simple and efficient type of generator or motor is produced.



THE ZUCKER & LEVETT DYNAMO.

Automatic regulation is secured by the extremely low resistance of the armature. These machines are also well adapted for lighting and power work.

One of the novel applications of this apparatus is at the sewerage purifying system of Brewsters, N. Y., where an American giant generator is in successful operation.

The exhibit was installed by Mr. M. Mayer, the electrician of the company, and is under the supervision of Mr. M. H. Levett, the manager of their Western branch.

Arc Lamps at the World's Fair.—II.

SCHUCKERT & CO.'S ELECTRIC SEARCH LIGHTS AT THE WORLD'S FAIR.

BY FRED W. TISCHENDOERFER.

Hitherto, when parabolic mirrors for search lights have been spoken of, it has been tacitly understood that such mirrors were made of metal brought to the desired form on a suitable block; such mirrors, however, have faults of different kinds.

1. They cannot be constructed accurately enough in the form of a paraboloid of revolution. 2. The reflection from the surface of a metal reflector is much less than from the surface of silvered glass. 3. The surface of the metal reflector soon deteriorates through oxidation, and from the frequent cleanings disadvantageous changes occur.

The difficulties of constructing glass parabolic reflectors, which appeared until quite recently insuperable, led Mangin to invent his well known reflector, and induced Tschikolew, in St. Petersburg, and Siemens, in Berlin, to construct their reflectors as an approximation to the parabolic form.

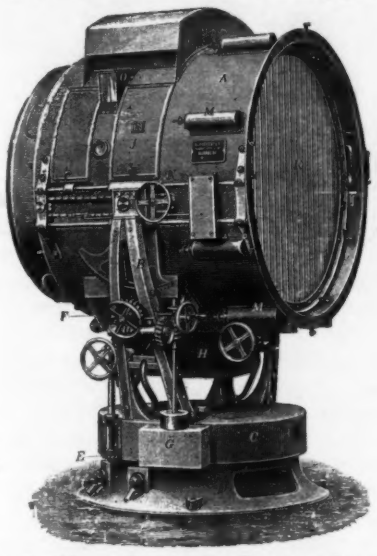


FIG. 1.—90-CM. STANDARD SEARCH LIGHT OUTFIT FOR WAR VESSELS.

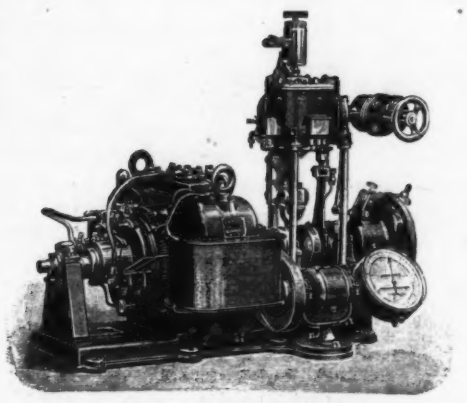


FIG. 3.—SMALL MARINE DYNAMO.

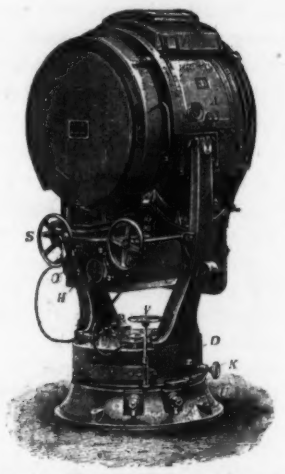


FIG. 4.—45-CM. SEARCH LIGHT FOR FIELD SERVICE.

Messrs. Schuckert & Co., of Nuremberg, with the collaboration of Prof. Munker, were the first to completely overcome the difficulties, and by the construction of a special machine can now make parabolic mirrors with sufficient accuracy for all practical purposes. The parabolic mirror surpasses all the other systems hitherto in use, and seems destined to supplant them by degrees. Quite setting aside the optical superiority of this type, the parabolic mirror—because with it the choice of focal distance is not limited—allows the use of lamps with carbons arranged horizontally from which the radiation of light takes place much more satisfactorily than with inclined or vertical carbons.

Until now Messrs. Schuckert have been the sole makers of projectors with parabolic reflectors, and projectors with reflectors 40 cm., 45 cm., 60 cm., 75 cm., 90 cm., 110 cm. and 150 cm. in diameter have been constructed. These are made in the following types:

1. Projectors for the army, in which, on account of transportation, the smallest possible weight is secured. 2. Projectors for use in the navy, which are specially made to secure easy working on board of ships. 3. Projectors for the merchant service, which are confined more to ordinary and smaller types, and serve more particularly for the passage of canals, narrow waterways, and for the purpose of sighting buoys, etc., at night.

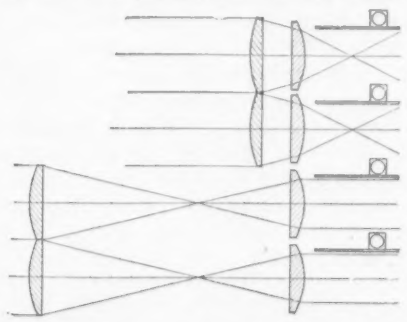


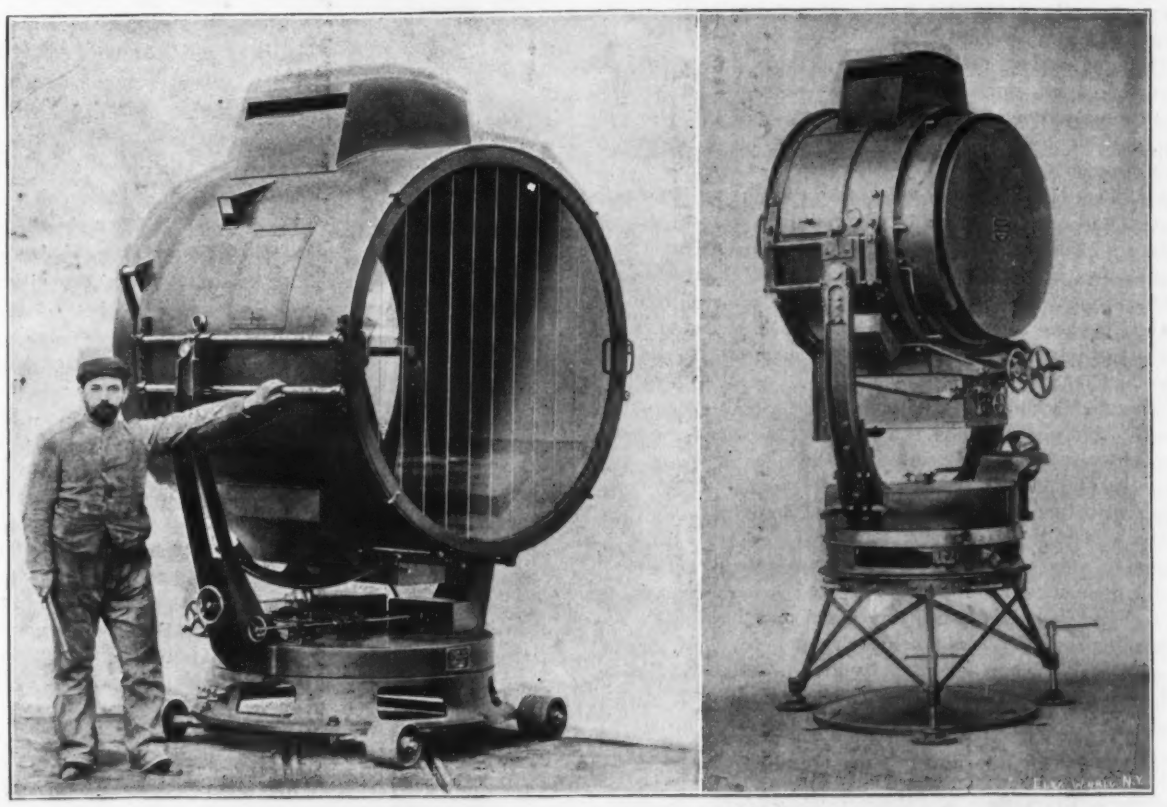
FIG. 2.—DEVICE FOR VARIABLE DISPERSION.

In these classes there are also different types, especially in class 1—as, for instance, the type used for coast defence, for use in fortresses or against fortifications, for field service, for turrets or for balloons. It would lead us too far to explain the special construction of all these apparatus; it must, therefore, suffice to describe some characteristic types. The apparatus shown in Fig. 1 is built for a current of 120-150 amperes, and has a parabolic mirror of 90 cm. diameter, and is intended for the navy. The frame A rests with trunnions in bearings in the side frames B, which are fixed on a turntable C; the table C turns on rollers upon a cast iron base D. There are, therefore, two rotary motions possible, one in a vertical, the other in a horizontal plane, so that it may be placed in any desired position. For both rotary motions fine adjustments and clamps are arranged so that either fast or slow motion can be given to any point on the horizon. The slow motion of the projector is, for both movements, also controlled from a distant point, such as the bridge of a ship; this is done by using worms which gear into the worm wheels of the slow gear placed on the spindles of small electromotors in the projector frame, and those may be operated from the bridge.

A switch is provided with contacts so arranged that the current can pass the armatures of the motors in either direction, so as to obtain any movement the observer may desire. The projector is thus under the direct control of the officer on watch, so that mistakes in carrying out orders are entirely avoided; the current needed for the movement is obtained from the main current, used in the projector itself. The motor used for the motion in a vertical plane is fixed to the turntable C inside of a box G, while the motor used for the motion in a horizontal plane is placed upon the fixed bedplate. The system of moving projectors from a distance by means of electric motors has been used by Mr. Schuckert for several years. The parabolic glass mirror is fixed to the projector casing by means of screws and nuts; the casing is not completely closed underneath, but allows a space, H, for the horizontal lamp, permitting it to be moved along grooves parallel to the axis of the projector, so that the crater of the positive carbon may easily be brought to the focus of the mirror. The carbon holders reach up to the centre of the casing, the carbons themselves being in its axis. In order to make it easier for the attendant to observe the position of the carbons and shape of the crater while the apparatus is in use, and to enable him to put in new carbons when required, small optical projectors are arranged at the side and on top of the casing which throw an image of the arc as seen from above and from the side upon the same plate of the ground glass, O. The image of the crater surface should be covered by a vertical image, if the crater is exactly at the focus of the reflector; if it should not be so, then this position will be obtained by moving the whole lamp. By means of side doors arranged in the casing the screws on the carbon holders are reached so that the carbons can be put into the proper position. At the front end, opposite the reflector, the casing is closed by a system of dispersers which consist of single glasses of planoconvex cylinder lenses. The lenses of the inner disperser are completely covered by those of the outer disperser K; the inner one can be moved parallel to itself and along the axis of the projector toward the outer one along the slide L; the outer one rests on rollers on the same slides, but is kept in position by a number of springs M, placed at equal distances around the circumference of the casing.

If the inner disperser be moved so that the two dispersers are distant from each other a space equal to the sum of their focal length, then the rays of light, a a (Fig. 2) reflected from the mirror are so refracted that they meet at the focus and diverge thence. The focuses of the two outer dispersers have a shorter focal length; when the diverging rays pass through these outer lenses they become parallel again. As the outer lenses have a shorter focal distance than the inner ones, they are not struck in their whole width by the diverging beams of light, and thus there remains between the rays which have been rendered parallel by passing through the two lenses a space which receives no light and allows room for the shutter, F, of a kind of darkening apparatus.

On the upper half of the figure the lenses of both dispersers are represented close to each other. The rays coming from the parabolic mirror through the first system of lenses will be refracted as in the former case, but before they reach the focus they strike the second lens and are caused to converge still more, so that the two lenses act as one with a shorter focal distance. As the rays of light leave the lenses, converging toward the focus and there cross and diverge, there remains with this arrangement a dark space for the shutter of a darkening apparatus. Each position of the movable dispersers between their two extreme positions corresponds to a certain angle of spread, so that, therefore, by a simple movement of one disperser by means of the hand wheel N, all degrees of spread can be obtained which are between the concentrated beam with about 6 degrees spread in a horizontal direction and the maximum spread of about 45-48 degrees. The darkening or signaling apparatus is mounted in front of the outer disperser, and, as it does not in any way interfere with the light, can always remain in position, so that the projector is always ready for flash signaling, which is of great moment on board of ships. As we have already said, the outer disperser is not fixed to the casing, but kept in place by springs. This arrangement has been used to allow of elasticity in the direction of the axis of the projector, as if it presented a solid surface it would be in danger of being broken by the atmospheric pressure produced by firing heavy guns. The arrangement just described is known as the "double disperser," and is in use in many vessels of war; it has the following advantages:



FIGS. 5 AND 6.—SEARCH LIGHTS FOR COAST DEFENCES AND MOUNTAIN FORTIFICATIONS.

1. The change from concentrating glasses to dispersers is spared if it is required to change the illumination of a large area to illuminate more brightly a smaller surface, or vice versa. 2. A dispersed or a concentrated beam can, in a very short time, be obtained. 3. The condition corresponding to a wide range of the required angle of dispersion can be obtained. 4. The signal apparatus can always remain on the casing ready for use.

Fig. 3 represents one of Messrs. Schuckert's combined dynamo and steam engines specially made for service on board of ships; the particular one illustrated was made for use on a torpedo boat.

A smaller projector, shown in Fig. 4, has a mirror of 45 cm. diameter, and is intended for field service in the army, as well as the merchant marine. The casing

is similar to that of the large apparatus, and is movable in two directions around a vertical and horizontal axis, and for both movements it is fitted with fine adjustment. With a view of making the smaller projector as well as the larger type suitable for use on board of ships, it is provided with a "double disperser" and an electromotor. If it is sufficient that a change can be made from a concentrated beam to the greatest spread, without passing through all the various degrees of spread and power of illumination, then the disperser may be much simplified by mounting one glass close in front of the other, each composed of alternate strips of plano-convex and plano-concave lenses, which could be made to slide past each other sideways, the exact breadth of one strip. In the one case two plano-convex or two plano-concave lenses stand opposite each other, and the projector is arranged for the greatest spread, while in the other case a concave glass is in front of a convex, and vice versa, so that the curved surfaces are parallel to one another, and the light leaves the lenses in a concentrated beam without material change.

The gear for moving the outer disperser in front of the inner one consists of a screwed spindle placed on top of the casing, and provided with a hand wheel.

The casing, A, is carried on trunnions by the uprights, which are fixed with screws to the turntable D. The latter one turns upon rollers upon the bedplate U. A screw and a hand wheel is provided at O, for fine adjustment of the projector in the vertical plane, and it can be moved in a horizontal plane with coarse adjustment by slackening the screw clamp K, and with fine adjustment at the hand wheel V. The horizontal lamp, H, is placed under the casing in grooves, and the proper position in the focus is obtained by a hand wheel, S, which works with a screw. At B an apparatus is fixed in the casing which throws the image of the arc upon a disc of ground class, and a vertical mark shows when the crater is exactly in the focus. By observing this image it can always be seen if the carbons are burning properly, and their position can be altered and the crater be adjusted to the exact focus. This particular projector is especially intended for field service, and is therefore made as light as possible. The larger projectors, up to 2 metres diameter, when intended for similar use, are made in the same way. Those for use at sea are of heavier type, with the exception of those for torpedo boats, which are constructed entirely of wrought iron, except the baseplate, so as to obtain the least weight. An apparatus of such kind for a first-class torpedo boat contains a reflector of 140 centimetres diameter, and weighs about 110 kilogrammes.

The lamps of the projectors are generally arranged for automatic regulation, but hand regulating apparatus is always provided as well.

The regulating mechanism of Piette and Krizik is used for lamps which have to be moved around frequently, and therefore need to be as light as possible, but for ship use, and for projectors which are subjected to shocks, a new type of lamps is used.

Fig. 5 represents a search light apparatus of 60 centimetres diameter as in use for the fortifications of the St. Gothard Mountains in Switzerland. Posted always at a fixed point, it is provided with a sight and the horizontal and a vertical movements, divided in degrees, so that by night time any desired destined point may be lit up without searching for it, for it has been adjusted by the day time and registered in record.

The search light apparatus as shown in Fig. 6 is the most powerful ever made. Its mirror diameter measures 150 centimetres and its lamp is built for 150 ampères, whereby 60 volts are needed at the terminals of the lamp. The positive carbon is cored and has a diameter of one inch and a half and the negative carbon of one inch. For the parabolic glass mirror in connection with the carbons being in the geometrical axis of the parabolic, a very simple relation to find out the intensifying power and luminosity (see "Zeitschrift des Vereins deutscher Ingenieure," vol. XXXVI., page 955). The surface intensity measured at the mirror $T = m\,i$, where m is the intensifying power of the mirror and i the average intensity of rays received at the mirror by the arc. The intensifying power is $m = \frac{D^e}{d^e}$ where D is the mirror diameter and d the diameter of the crater of the positive carbon. The intensifying power of that large search light projector is m = 4,253 (d being 23 millimetres). The average intensity of rays i = 45,600 c. p., therefore the surface intensity T = 194 million candle power.

A search light of that size is posted in the World's Fair grounds at the northwest corner of the middle roof of the Manufactures Building at a height of 230 feet. The beam of light has been seen in Milwaukee, Wis., 85 miles distant, on July 15, 1893, and in Antioch, Ill., 65 miles distant, on Aug. 5, 1893. By this light a person standing in the beam of light at a distance of 10 miles is able to read a newspaper. Standing by the side of that large apparatus one is able to detect at a distance of twenty miles moving or approaching troops or war vessels by aid of a good field glass. Such large search lights are especially used for coast defenses, in order to throw their light such an immense distance that it is impossible that they may be reached by gun balls. The trainage and the vertical motion of the beam of light, i. e., the apparatus, is electrically controlled, so it may be operated by the commander himself from any distance desired.

On the middle roof of the Manufactures Building are still three other search lights of Schuckert & Co. in operation, of different sizes and outfits. In Schuckert & Co.'s exhibit, Electricity Building, German section, are some more search lights—projectors exhibited with the most complete outfit for war vessels; they are partly in operation. Besides, there are navy dynamos and signaling apparatus—all for use for navy and war purposes.

All official comparative tests by eight different governments have approved without any exception the great superiority of Schuckert & Co.'s search lights as well for their luminosity as in the operating of their apparatus. The World's Fair representative of Schuckert & Co. is very anxious to make comparative tests with any other apparatus, operated under like conditions.

The projectors made by this firm have come to the front rapidly. They are used in the German army and navy, and also in Russia, Austria, Switzerland, Sweden, Belgium, Netherlands, Denmark, Italy, England, China, Japan, for fortifications as well as for the merchant service and navy; they were used by the Italian expedition to Massowa, mounted on the special wagons made by the same firm, and did good service.

THE HELOIS ALTERNATING CURRENT ARC LAMP.

The Helios arc lamp is the invention of Carl Coerper, of Ehrenfeld, Germany, with some minor improvements made by the Helios Electric Company, of Philadelphia, Pa.

This lamp has been designed with a view to its use indoors as well as outside, and one of the first considerations was the selection of a potential which would make it absolutely safe to the user. Hung from low ceilings, as such lamps frequently are, personal contact with them is liable to occur at any time. The transformer is placed out of doors and inaccessible. Its location removes at once all danger of personal injury. In addition to this, the low tension of 30 volts makes the matter of insulation one of indifference; that is to say, it requires no special precaution, but is subject to the same rules only as would apply to 50-volt incandescent lamp wiring.

As is well known, an alternating arc lamp usually makes a noise, which has been one of the principal objections to its use. In the Helios arc lamp this has been so reduced and softened that, under ordinary circumstances, it is not noticeable.

Fig. 1 shows the lamp with globe and cap removed. The construction and operation involve the most simple mechanism. As will be seen, the lower carbon holder is attached to a chain which is carried over a pulley in the lamp mechanism, the other end being attached to the upper carbon holder. The result of this arrangement is that as the lower carbon ascends the upper carbon descends, and exactly in the same ratio. The arc is thus fixed at a given point and remains stationary from the time the current is turned on until the carbons are consumed.

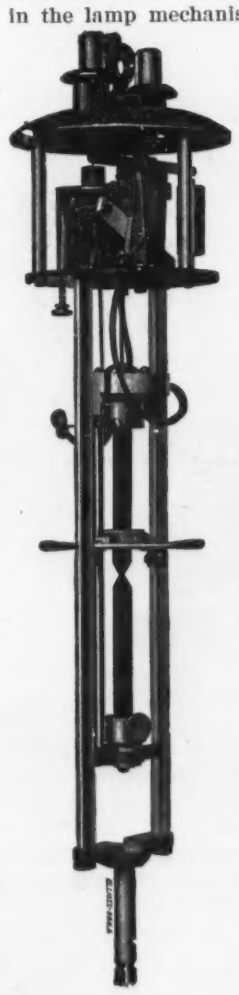


Fig. 1.—Helios Lamp with Globe and Cap Removed.

As is well known, the alternating arc forms a crater both in the upper and lower carbon, so that considerable light is emitted by the crater of the lower carbon, which is thrown upward and thus generally wasted. This has been overcome by placing about one-half an inch above the arc, a white enameled reflector, which throws down all the light emitted from the lower carbon, increasing the illuminating power at least 40 per cent.

The regulation is effected entirely by a single solenoid coil, the feed of the carbon being controlled by a lever which presses against the periphery of a friction wheel included in the releasing train. By this means a feed of one-thousandth of an inch is made possible. The upper carbon holder is made so as to slightly overbalance the lower carbon holder. The result is that the work of the solenoid coil and mechanism is restricted simply to the small weight representing the difference between the carbon holders. A free piston air dash pot serves to steady the movement of the regulating mechanism. The method of striking the arc is shown diagramatically in Fig. 2. D is the chain pulley over which the chain and its axis are supported by standards. A is a lever, swinging loosely on the same axis as the chain pulley, and is connected to another lever through which it obtains its motion from the solenoid plunger. F is the friction wheel connected through a reducing train of gears to the chain pulley. B is the press lever which moves between two stationary pins, C C. On one side of the end of this lever is an inclined plane, and on the other side is fastened a spring. When the current is thrown on, the plunger of the solenoid is drawn down and the resulting motion in the train of levers is indicated by the arrows. Lever A revolves about its axis until lever B has descended upon the periphery of wheel F, thereby holding the train of gears and causing the chain pulley to turn through a small angle with lever A. This motion of the chain pulley causes the separation of the carbons and establishes the arc. This condition is maintained so long as the current remains constant, but as soon as the consumption of carbon has increased the separation between the points beyond the proper distance the current decreases as a result of the lamp being on a constant potential circuit and an increase of resistance in the greater separation of the points. This decreases the pull of the solenoid and releases the friction wheel and

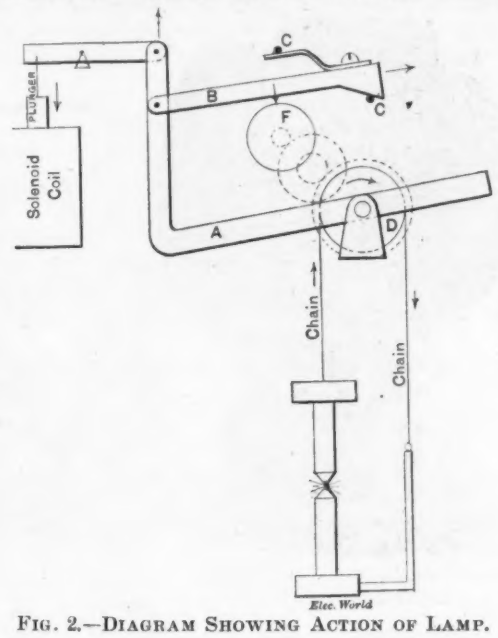


Fig. 2.—Diagram Showing Action of Lamp.

its train, so that the overbalanced weight of the upper carbon holder causes the points to approach each other until the current again increases to the normal amount. This gives a very delicate feed motion and results in a steady light. The only electrical device in the mechanism of the lamp is the solenoid, and the current is taken from the lamp binding post through the solenoid, then by means of a flexible cable directly to the carbon holder, which is insulated from the frame of the lamp. The other carbon holder, also insulated from the frame of the lamp, is connected directly by means of a flexible cable to the other binding post of the lamp, so that no part of the lamp frame is in open circuit. The lamp can be run from any 50 or 100-volt circuit by using the Spencer coil, which is a secondary transformer, and reduces from 50 or 100 volts to 28 volts. When installed in this way the current can be metered the same as for incandescent lighting. When used for street lighting, a special transformer to reduce from 1,000 or 2,000 volts primary to 28 volts is required. These lamps can be seen in service on the Midway Plaisance and in the exhibit of the Ansonia Electric Company in the north gallery of the Electricity Building.

A Municipal Electric Light and Power Plant.

The city of Rotterdam has contracted with Siemens & Halske, of Berlin, for the erection of a city electric plant for lighting and power transmission. It is proposed to use the direct current five-wire system, of the advantages of which the leading members of the City Council had been convinced by the success at the central stations at Wien Neubae, Trient and Paris-Clichy.

From the generator station the current is carried to the sub-stations, distant respectively 0.9 and 1.6 miles. One sub-station will supply the main business district of Rotterdam, principally with current for lighting purposes, while the other station furnishes current for the running of motors on the numerous dock-cranes, drawbridges, elevators, etc. The plant is expected to be running by the first of next year.

A Proposed New Unit.

We hear that a unit of earthquake has been decided upon and adopted in a paper recently read before the Royal Society, so that the magnitude of a seismic convulsion can now be scientifically expressed to any number of decimal places. To be quite scientific, however, the C. G. S. system should be used, and the earthquake should be expressed in terms of length, mass and time and all the suppressed dimensions. Omitting the latter, the C. G. S. unit of earthquake might be defined as that amount of quake which, acting on a gramme mass of the earth's crust with a frequency of one harmonic vibration per second, would cause it to heave up and down with an amplitude which would increase at the rate of one centimetere per second. Then the unit should have a name—that of some famous defunct seismographer would probably be the most serviceable; and there should be a huge "practical" unit, and a microscopic "absolute" unit connected together by 10 to no end of powers. But perhaps the unit selected is not "scientific"—only convenient.—London "Electrician."

THE ELECTRICAL WORLD'S DIGEST

OF

CURRENT TECHNICAL ELECTRICAL LITERATURE

(Compiled from the principal foreign electrical journals.)

BY CARL HERING.

(Note.—Although this department has been omitted for several issues, due to the reports of the International Congress, it will continue to be a complete record, as all journals received during the intervals will be abstracted in this and sub equent issues. Those who keep a complete file of the "Digest" will please take notice that the following articles which appeared in the issue of Aug. 26 belong to this department: p. 146, 3d column; p. 151, three paragraphs in 3d column, and p. 153, 3d column.)

ELECTRO-PHYSICS.

High Frequency Currents.—Mr. Rimington, in the Lond. "Elec. Rev.," Aug. 11, discusses at some length the explanations of the lighting of a 5 c p. 100 volt lamp by very high frequency currents; he states that the explanation which has been offered that the lamp has a very much higher resistance due to the high frequency and therefore takes a very much smaller current seems hardly satisfactory; since it is reasonable to suppose that the lamp consumes the same power when giving its full candle power, whether with low or high frequency currents, the C^2R must be constant, if the power supply to the lamp be due to the current overcoming the resistance; if the current be reduced to, say, one-tenth, the resistance of the lamp would have to become 100 times as great. He then deduced a diagram based on Lord Kelvin's figures for the increase of resistance of a conductor due to alternating currents, and shows that to double the resistance of the lamp a frequency of about 40,000,000,000 will be required. He then calculates at some length the probable frequency obtained by Mr. Swinton in his experiment and finds that it was only a few hundred thousands. He concludes from this that the frequency could hardly have been sufficient to produce the required increase of resistance, which, he says, makes it necessary to look for some other cause for the incandescence of the filament than the heating effect of the current overcoming electrical resistance; possibly it is due to molecular bombardment as suggested by Tesla.

Sparking Distances.—A Roy. Soc. paper by Mr. Peace on "The Potential Difference Required to Produce a Spark Between Two Parallel Plates in Air at Different Pressures," is reprinted in full in the Lond. "Elec. Rev.," Aug. 11, and constitutes probably one of the most complete and reliable series of tests made for those ranges. The apparatus is illustrated and described and the results are given in tables and curves, which are too numerous to be reproduced here. Among the features noticed was that as the air pressure diminished the voltage required to produce a spark across a given distance fell to a minimum value, and then began to increase rapidly; also that the curves connecting the voltage and the air pressure cross each other, showing that at low pressures the shorter spark required the greater voltage. From the observed voltage the electrostatic force was deduced, that is, the potential difference in electrostatic units per centimetre of spark length; the pressures varied from a few millimetres to 300 (therefore not including atmospheric pressure), and the spark lengths varied from .0004 to .08 inch.

Brush Discharges in Gases.—The Lond. "Elec. Rev.," Aug. 11, calls attention to a paper in the July number of "Phil. Mag.," by Messrs. Harvy and Hird, in which the difference in the behavior of positive and negative electricity is shown; oscillatory discharges of high frequency and high potential were used, and it was found that in a brush discharge in dry air, positive electricity passes more readily from a point than negative does; the same is true for oxygen, but in hydogen the reverse holds.

Mechanical Equivalent of Heat.—Mr. Appleyard in the Lond. "Elec. Rev.," Aug. 11, describes at some detail a recent determination by Messrs. Griffiths & Clark (a full account is contained in the Phil. Trans. of the Roy. Soc., vol. 184, pages 361 to 504). The method used was an electrical one, and the experiments appear to have been carried out with great care. The results are briefly as follows: Assuming the value of the ohm as 106.3, and that of the Clark cell at 15° C. as 1.4342 volts, and taking the thermal unit to be the quantity of heat required to raise 1 gram of water through 1° C. at 15° C., the most probable value of J is $4\,1940 \times 10^7$ (although not so stated, yet it evidently means that 1 klgr. C° unit of heat = 4194.0 joules); from the deductions, which are not stated very clearly, we take the following, which is evidently that which was meant: 1 klgr. C.° unit of heat = 427.45 klg. metres in the latitude of Greenwich (g = 981.17); 1 lb. C° unit = 1402.2 ft. lbs., and 1 lb. Fahr. ° unit = 778.99 ft. lbs., both in the latitude of Greenwich.

Potential of the Atmosphere.—According to the Lond. "Elec. Eng.," Aug. 11, Mr. Chauveau, who has made daily experiments for almost a year, finds that the difference of potential of the atmosphere at the bottom and the top of the Eiffel tower (1,000 feet) varies from 3,000 to 7,000 volts, and that on bright, clear days in summer it often reaches 10,000 volts; the means of obtaining the potential of the surrounding air is that suggested by Lord Kelvin, and consists in discharging fine streams of water through the air. In winter a gas flame is used instead. The brief description of the apparatus in that abstract is somewhat meagre and unsatisfactory.

Luminiferous Ether.—The Lond. "Elec.," Aug. 4, reprints an address by Sir G. C. Stokes on this subject, only a very small portion of which, however, concerns electricity. In speaking of electro-magnetic waves, he says that they are strictly of a similar nature to the waves of light, but that there is an enormous difference in the scale of wave lengths; in the case of light they are about one fifty-thousandth part of an inch, while in the electro-magnetic waves that have been investigated they are from a few inches to many yards.

Oscillations of Small Wave Lengths.—The Lond. "Elec. Rev.," Aug. 18, gives a short description, though not as clear as might be desired, of a new form of apparatus devised by Mr. Righi for producing oscillations of small wave lengths; the wave length of the radiation obtained was 20 cm. with metallic balls 4 cm. diameter, while with balls of 1.3 cm. diameter they were about 7 cm.

Hall Effect.—The Lond. "Elec. Rev.," Aug. 25, states that Kundt has found that the Hall effect is proportional to the magnetizing force, and that while cast bismuth shows the effect to a considerable degree, the effect is very weak in bismuth which has been obtained by electrolytic deposition.

Absorption of Light by Platinum.—According to the Lond. "Elec.," Dr. Rizzo has found that the transparency of platinum increases with the temperature, especially in the more refrangible regions; according to the electro-magnetic theory of light both the resistance and the transparency of a conductor should increase, while those of a dielectric should diminish, with a rise of temperature; the results of his experiments, therefore, as far as they go, are in agreement with this theory.

Transparency of Ebonite.—The article referred to under this heading in the Digest Aug. 19 is reprinted in full in the Lond. "Elec.," Aug. 4.

Resistance of Thin Liquid Films.—In a recent Roy. Soc. paper by Profs. Reinold and Rucker, they discuss the cause of the increase of electrical conductivity of thin films; a brief note will be found in the Lond. "Elec.," Aug. 18.

Gravitational and Electromagnetic Analogy.—In the Lond. "Elec.," Aug. 4, Mr. Heaviside contributes a second article on this subject; the article is of a theoretical nature.

Velocity of Gravity and a Resisting Medium.—The Lond. "Elec.," Aug. 4, contains another brief contribution by Mr. Lodge and one by Mr. Larden on this subject.

MAGNETISM.

Magnetic Viscosity.—The Lond. "Elec. Rev.," Aug. 18, reprints an abstract of a Roy. Soc. paper by Dr. J. Hopkinson and Messrs. Wilson and Lydall, in which the experiments are briefly described. The conclusions drawn from them are as follows: After a sudden change of magnetizing force the induction does not at once attain its full value, but there is a slight increase going on for some seconds; the small difference between the ballistic curve of magnetization with complete cycles, and the curve determined with a considerable frequency, is a true time effect, the difference being greater between a frequency of 72 per second and 5 per second than between the latter and the ballistic curve.

Electro-Chemical Effects on Magnetized Iron.—The Lond. "Elec. Rev.," Aug. 25, reprints a Roy. Soc. paper by Mr. Andrews, in which are described in detail the electro-chemical properties of two pieces of iron in two arms of a U tube, one of them being magnetized, while the other is not; the results are given for a number of different solutions. The effect was found to vary with the nature of the metal and the solution, as also with the extent of the magnetic saturation and the density of the solution; with uniform strengths of solution the effect became proportional to the magnetism; in bromine and potassium bromide solutions the E. M. F. between the unmagnetized and the magnetized bar sometimes reached as high as .05 volt. He states also that in an emersed magnet local currents circulate between the more highly and the less highly magnetized parts, that is between the poles and the neutral line, the former being positive to the latter.

UNITS, MEASUREMENTS AND INSTRUMENTS.

Practical Measurements of Alternating Currents.—In January Prof. Fleming delivered several Cantor lectures before the Academy of Arts on this subject, which are reprinted in full in the Lond. "Elec. Eng.," Aug 18 and 25, and the first one in abstract in the Lond. "Elec.," Aug. 25; the first one is on the measurement of currents and the second on the measurement of voltages. After an introduction to the subject and an explanation of the "square root of the mean square" value, he describes briefly a number of instruments in actual use for measuring alternating current strengths; all of these are for direct measurement only; indirect measurements not being taken up. In his second lecture he takes up the subject of alternating current pressure; after a brief, but clear, explanation of the meaning of impedance, inductive and non-inductive resistances, he describes briefly a number of instruments for measuring such voltages directly, no indirect methods being considered. The article is accompanied by a number of cuts of the instruments. Although the lectures contain nothing new, they are well written, and are recommended to those interested in this subject.

Testing Lightning Arresters for Telegraph Lines.—The Lond. "Elec.," Aug. 18, reprints a translation of an article from "Ann. Télégraphique," by Mr. Massin, on the comparative effectiveness of lightning guards. He points out the difficulties involved in testing such apparatus, and describes a method which overcomes all the difficulties, and in which he compares the simultaneous behavior of two lightning arresters toward the same discharge, as distinguished from two supposed identical discharges; the arrangement is a sort of Wheatstone bridge, the Leyden jar being discharged through two arresters in multiple, together with an arrangement for determining the discharge which has traversed each of the arresters; in this way he compares different arresters with a certain form which may be used as a unit for comparison, the behavior of the others being expressed in terms of the air gap that it is necessary to give the standard apparatus in order to get a balance. His method of testing the relative effectiveness of plate, comb and mica sheet protectors appears to be reliable. Among the conclusions to which we are led are that the effectiveness of the air gap plate protectors depends only on the distance between the metallic plates and their degree of polish; that air gap comb protectors are comparable with plate protectors; they are not so liable to be short-circuited, and they dissipate quietly the charge that is not sufficient to spark across; that gutta-percha and mica should give place to paraffine paper in insulating sheet protectors, the paper being as thin as possible.

Resistance Measurements.—In the "Ann. d. Phy. u. Chem.," No. 6, Prof. F. Kohlrausch describes the limits of the method of determining electrical resistances by means of alternating currents; a short note will be found in the Lond. "Elec. Rev.," Aug. 25.

Testing Storage Batteries.—The Lond. "Elec.," Aug. 25, describes an apparatus for making a complete test of secondary cells, and containing only a single measuring instrument in the form of a Holden-d'Arsonval galvanometer with a 10-turn coil; a diagram is given showing all the connections.

Clark Cells.—Dr. Kahle, of the German Imperial Institute, gives results of his comparative tests of Clark cells in the "Zeit. f. Instrumentenkunde," a short abstract of which is given in the Lond. "Elec.," Aug. 25. In his opinion the H form suggested by Lord Rayleigh, and modified by himself, is the best for permanency, for transporting and for reproduction; the Board of Trade form shows irregularities up to 1 per cent. due, he says, to the want of saturation of the zinc sulphate solution at some points of the surface of the zinc, and also to the passage of some particles of the zinc through the paste into the mercury; the substitution of cadmium for zinc he regards as a promising innovation; he believes the Clark cell should supersede the silver voltameter as a calibrating and measuring instrument; the majority of the cells constructed at Charlottenburg have been reliable to within one part in ten thousand.

The Lond. "Elec. Rev.," Aug. 25, reprints a paper by Dr. Kahle, of the German Imperial Institute, in which he describes in detail the construction of these cells based on the results of experiments made at that Institute.

Meters.—Mr. Meikle, in a Phil. Soc. paper, reprinted in the Lond. "Elec.," Aug. 18, describes several of Lord Kelvin's new meters and indicators, the article being accompanied by eight illustrations. The descriptions are not as clear as might be desired; the underlying principle seems to be the sucking of a core into a solenoid, the core itself being a soft iron bar, which is kept saturated by a current passing through a fine wire coil wound upon it, the current through this coil being about .025 ampere, which is about 25 per cent. more than sufficient to keep the iron fully saturated, thus making it virtually a permanent magnet; this is said to allow much greater masses of iron to be used with good results, and also a greater range to be had from one instrument. The large electric voltmeter for the Edison company in New York, which is said to be the largest voltmeter in the world, is based on this principle, the movement of the core being transferred by a rack and pinion to a pointer revolving on an axis; the plunger is about 24 inches long, and about ⅜ inch in diameter, being wound with 30,000 turns of wire; the current is led out and in by means of two spiral supporting springs; from 60 volts upward saturation is complete; the diameter of the dial is about 30 inches.

A New Photometer.—The Lond. "Elec. Rev." recommends a paper by Mr. Mayer in the August number of the "Phil. Mag.," in which special attention is paid to simultaneous contrast colors.

Amperian Apparatus.—The Lond. "Elec.," Aug. 25, describes a new arrangement in which the Amperian frames are suspended by a silk thread, contact at the top being made by passing the wire through a suspended globule of mercury.

Nomenclature.—The Lond. "Elec. Rev.," Aug. 11, suggests that it would be decidedly useful to have a name for the quantity pL, or $1 + pK$, in which p is equal to 2π times the frequency; the quantity is measurable in ohms; the name "inductance," used by Dr. Sumpner, is claimed to be an unfortunate name to employ, as it is already in use as synonymous with coefficient of self-induction, to which it is, for brevity's sake, preferable.

DYNAMOS AND MOTORS.

Prevention and Control of Sparking.—The Lond. "Elec. Eng.," Aug. 4, reprints from the "Jour. of Inst. of Elec. Eng." Mr. Sayer's reply to those who, in the discussion of his recent paper, asked for some definite estimation of the cost and efficiency of his new machine as compared with the ordinary smooth coil machine. As a comparison an Edison Hopkinson machine of 1886 was used; cuts, calculations and data are given, the latter in the form of several tables, from which, among other things, it appears that in the Sayer machine the armatures and conductors

weigh and cost slightly more, the reversing bars (commutator coils) are of course extra, the magnet coils weigh and cost considerably less than half as much, while the magnet wire weighs and costs about one-third as much ; the total of these items show that the cost in the Edison-Hopkinson machine is 75 per cent. more (or in the Sayer machine 43 per cent. less), while the weights in the former are 110 per cent. more (or in the Sayer machine 52 per cent. less); there will be a further saving of material in the bedplates on account of the lighter magnets, and if compounding is required the whole cost of extra material and labor will be saved, as the Sayer machine can be compounded without any series coils; no cost of the labor is given, as that depends greatly on the details of the design; besides the above gains, he claims superiority from a mechanical point of view, the discs and armature wires being all positively driven and the armature presenting a smooth surface.

Sparking of Dynamos and Motors.—A translation of the article by Mr. Rechniewski abstracted in the issue of Aug. 26, page 146, is reprinted in full in the Lond. "Elec. Eng.," Aug. 18 and 25.

Arc Light Generators.—Mr. Carter, in his serial on arc lighting in the Lond "Elec. Rev.," treats of this subject at some length, dividing generators into different classes, and discussing the principles underlying their design ; the article appears to be of a practical nature.

Regulating Arc Light Machines.—Mr. Carter, in his serial in the Lond. "Elec. Rev.," Aug. 25, discusses the subject of regulators for arc light machines, describing several different forms with the aid of cuts.

TRANSFORMERS.

Efficiency of Transformers.—Mr. Claude, in "L'Ind. Elec.," July 25, describes a simple method of some interest for measuring the efficiency of transformers. This method, although theoretically not quite exact, is, notwithstanding, said to be capable of giving results which are sufficiently so for most purposes ; it is applicable, however, only to transformers of not more than three to four kilowatts, and particularly to those in which oil is used. In this method he measures the total losses in the transformer, from which the efficiency is then calculated ; the transformer is placed in a room where the temperature is constant, and a thermometer is suspended in the oil used for insulation ; it is first run with the secondary circuit open until the temperature reaches a constant value, which, with a four-kilowatt transformer, will be in about seven to eight hours ; the transformer is then loaded to its maximum power, and run until the temperature has again become constant ; the second temperature will be about 10 degrees to 20 degrees C. higher than the preceding. The same transformer is then connected to a constant current source, the current, the voltage, and the maximum temperature being measured; the latter is repeated for several different currents and the results plotted in the form of a curve whose ordinates are temperature and the abscissas are the watts lost; on this curve find the two temperatures of the first two tests with alternating currents; the abscissas of these points will then give the watts lost respectively in the two cases; from this the efficiency may then be readily calculated; he applied this method to a Thomson-Houston transformer of 4.5 kilowatts and obtained exactly the same results as Mr. Fleming did in his tests, which speaks well for this method; it is not intended to replace the other methods entirely, but possesses a number of advantages over them, specially in rapidity, and when the complicated apparatus required for other tests is not at hand. It may be mentioned that a very small variation in the efficiency makes a very great variation in the temperature, for instance, a variation of one per cent. in the efficiency of a four-kilowatt transformer will make a difference of seven to eight degrees C in the temperature.

Condensers and Idle Currents of Transformers.—In the Lond. "Elec.," Aug. 4, Prof. Perry gives some curves showing the current and the lag of the current for a given hedgehog transformer, whose primary is shunted by a condenser and whose secondary is open. The values are calculated for various capacities ranging from zero to 1 5 micro-farads ; comparatively simple formulæ are given from which these values were calculated; the current curve is a hyperbole, but resembles very closely two lines inclined at nearly 45 degrees; the great lag changes very suddenly into a great lead at the point where the current is a minimum ; the effect of the condenser is to diminish the total current in a ratio of the resistance to the impedance.

Transformer Design.—Mr. Carter, in his serial on arc lighting in the Lond. "Elec. Rev.," gives a set of very simple practical formulæ, reduced to English units, for designing a transformer intended for running an arc lamp from high voltage mains; want of space prevents us from reproducing them here, but they are recommended to all interested in this subject. He also discusses briefly the differences between series and parallel transformers.

ARC AND INCANDESCENT LIGHTS.

Lighthouse Lights.—The Lond. "Elec. Rev.," Aug. 4, reprints in abstract several papers read at the recent International Maritime Congress. In one of them on flash lights, by Mr. Blondel, the author concludes that : (a) every source of light is capable of furnishing at each flash a quantity of light that depends only on its intensity and the coefficient of vertical concentration of the apparatus, and on the interval between the flashes, the latter being fixed at 5 seconds; (b) the electric flash can realize the maximum utility at any distance ; (c) the range that may be reached with electric flash lights is now no longer limited by the luminous intensity, but by the height of the tower. In a paper by Mr. Bourdelles on the luminous power of lighthouse apparatus, he states that in foggy weather it is merely necessary to increase the brightness as far as possible : two lights of the same total brightness, but having different intrinsic brightness would be unequal in range and visibility, although they might be equal in ordinary weather ; for this reason the preference should be given to the arc over incandescent lamps, and oil over gas, and in general to electric lamps over oil and gas lamps; he states that observations do not bear out the recently made statement that the intrinsic brightness produced by the arc is constant. In a paper by Mr. Gatto he concludes that the electric lighting of beacons from primary or secondary batteries possesses no special advantages, and that the Pintsch gas system is to be preferred; experience in Italy has shown that the lighting of beacons by compressed gas was the most reliable and best system known. The next paper is that by Mr. Blondel, on electric lighting of lighthouses, already mentioned in the Digest Sept. 2; among other things he states that the intensity of the current should vary at least in a ratio of 1 to 4, according to the degree of transparency of the atmosphere; in French lighthouses the two extremes were 25 and 100 amperes. From other papers it appears that for lighthouse purposes a magneto-electric machine gave the best results, especially that of De Meritens; also that the electric light is absorbed more largely by fog than either oil or gas lights, but that in all weather and at all distances its penetration has proved superior to that of gas and oil lights. The paper of Mr. Stevenson is abstracted more fully in the Lond. "Elec. Eng.," Aug. 18; in this he compares the number of times that the light from certain electric lighthouses was not seen with the number of times that the oil light of certain lighthouses was not seen, in all of which three cases cited the results are very greatly in favor of the electric light.

Electric Light for Lighthouses.—The paper of Mr. Blondel, mentioned in the Digest Sept. 2, is continued and concluded in the issues of the Lond. "Elec. Eng.," Aug. 4 and 11. In these two portions he considers the continuous current dynamos, showing why they are not applicable at present to lighthouses; also the use and advantages of alternating currents, concluding with the subject of alternating current dynamos, more especially that of De Meritens, and those intended to replace it. The paper is somewhat lengthy, and is accompanied by a large number of cuts; the matter relating to the experience in France is of interest.

Search Light in Pit Sinking.—In a recent paper before the Mining Institute of Scotland, a short abstract of which is given in the Lond. "Elec.," Aug. 25, Mr. Baird described an electric search light which has been applied to pit sinking near Paisley; the search light apparatus is placed over the mouth of the pit, and the light may be focused to the bottom or any other part of the pit; the advantages over other means of illuminating are evident; it is said to have been a great success, the illumination being far brighter than that produced by miners' lamps; (it would seem, however, that its application is limited to pits which are free from central elevators or other apparatus which would obstruct the light).

Incandescent Lamps with Reflectors.—The Lond. "Elec. Rev." reports the case of a 200 c. p. incandescent lamp made of green glass for a ship's side light, which was destroyed by the focusing of the heat rays upon its bulb by the reflector placed behind it, the heat being sufficient to soften the glass, after which the vacuum perforated it.

TRANSMISSION OF POWER.

Transmission of Power at Biberist.—The Lond. "Elec.," Aug. 11, gives a brief description of a plant just installed in this Swiss town by a Geneva company. Four hundred horse power, generated by water power, is transmitted to a paper mill 20 miles distant ; the turbine is geared by means of beveled gearing to two continuous current Thury dynamos with an output each of 40 amperes and 3,300 volts ; they are connected in series ; the field has six poles, and the armature is of the Gramme ring type ; the commutators are three feet in diameter and have 18 carbon brushes ; their efficiency is nearly 93 per cent. ; the motors are identical with the generator ; the total efficiency of the transmission is 78 per cent.; the lines are made of bare stranded copper seven millimeters in diameter, and the loss is 600 volts, or 9 per cent.; they are carried on wooden poles, and are protected by lightning arresters placed on many of the poles, and by condensers and impedance coils placed at the station ends.

Transmission of Power in Switzerland.—According to Lond. "Engineering," it has been proposed to dam the river Reuse and collect the water in a reservoir of 3,000,000 cubic feet capacity at Combe-Garrot, from whence the water is to be distributed to Neuchatel, Loche and La Chaux-de-Fonds ; the head will be 300 feet and the conduit will have a capacity of 177 cubic feet per second, although the flow of the river is only 60 to 100 ; the power will be distributed from the turbine stations by electricity a distance of 7½ to 11 miles.

ELECTRIC RAILWAYS.

Overhead and Underground Railways.—The following table gives some comparative data of the Liverpool Overhead Electric Railway and the City & South London Underground Electric Railway ; in the former each train consists of only two motor cars, while in the latter it consists of three cars and a locomotive ; the table is taken from the Lond. "Elec.," Aug. 11.

	City & South London Railway.	Liverpool Overhead Railway.
Length of line open	3¼ miles	5¼ miles
Total capital expended on line open	£873,000	£528,000
Capital expenditure per mile of line open	£280,000	£103,000
Present rate of passenger traffic per annum.	6¼ mill.	4½ mill.
Loco. and generating expenses per train mile	6 48d.	4d.
Passenger earnings per train mile	24.7d.	26.6d.

City & South London Railway.—The Lond. "Elec.," Aug. 11, publishes an interesting diagram, showing the increase in train mileage, and the decrease in locomotive and generating expenses per train mile, both from June, 1891, to June 1893 ; the former increased from about 140,000 to 220,000, while the latter decreased from 18 to about 13 cents.

Birmingham Tramways.—The reports of the Birmingham company are given in the London journals of Aug. 11, the fullest report being in the Lond. "Elec. Eng." This company, as is well known, operates all of four different systems. For steam the cost per mile was 22.44 cents, while the traffic receipts were 31.6 cents; horse power costs 20.24 cents, and the receipts were 21.58 cents; cable traction costs 12.64 cents, and the receipts were 32.2 cents; electricity costs 33.1 cents, and the receipts were 32.24 cents; the electrical lines, therefore, seem to earn the largest amount, while, at the same time, cost more than the others, the cost amounting to more than the receipts (it will be remembered that accumulators are used in the electrical lines).

Accumulator Traction in Paris.—According to the Lond. "Elec. Eng.," Aug. 11, Mr. Julien says that horse traction in Paris costs 10.4 cents per car kilometre, while traction by means of accumulators costs only 9 cents; the horse cars have only 48 seats, while the electric cars have 56; as the latter cars make eight trips daily, covering 115 kilometres, the increase of the profits is said to amount to $4 per day per car.

Accumulator Cars in Paris.—The Lond. "Elec. Eng.," Aug 4. gives a brief description, including data, of the Saint Denis lines in Paris, taken from an article in "Le Genie Civil"; no figures of costs are given.

Electric Rack Railway.—The Lond. "Elec. Rev.," Aug. 18, describes briefly the new electric mountain railway at Barmen recently constructed by Messrs. Siemens & Halske. The total length is a little more than one mile, and the total rise is 560 ft.; the average gradient is 1 in 10 and the steepest 1 in 5 ; each car accommodates 36 persons and has two independent motors each of 36 h. p.; each motor drives pinions which gear into the rack rail; four means of braking are provided; a current at 500 volts is used and is led to the motors by the usual overhead trolley construction ; the station also supplies current to private consumers for motor power purposes ; it is also intended to connect Barmen and Elberfeld by means of an elevated electric railway.

Electrolysis of Pipes.—A correspondent of the Lond. "Elec. Eng.," in the issue of Aug. 18, states that a complete protection of pipes against electrolysis can be obtained with two coats of what is called anti-sulphuric enamel ; this material is elastic, is an insulator, is unaffected by acids, and in general is claimed to be superior to other like substances.

European Electric Railways.—The Lond. "Elec. Rev.," Aug. 18, reprints a translation of the statistics recently published in "L'Ind. Elec." (see Digest Aug. 12), adding two corrections regarding the first two railways in Great Britain.

CENTRAL STATIONS, PLANTS, SYSTEMS AND APPLIANCES.

Utilization of Town Refuse for Power Production.—In the issue of Aug. 4 of the Lond. "Elec. Rev.," Mr. Tomlinson begins an extended serial on this subject, which is continued through the subsequent numbers of that journal. The article is of too great length to be abstracted here, even if the nature of the matter permitted it. It appears to be of an eminently practical nature, and includes a collection of data and deductions from existing destructor plants in England : he limits himself to results actually obtained. In the first part he gives the requirements of a good refuse destructor, as such, and states that they are not the same as the requirements for an efficient steam generator ; as the former are the most important, the efficiency as steam generators is of secondary consideration ; among the requirements of a destructor are very high temperature and long exposure to this temperature ; a boiler, however, cools the gases and makes combustion less perfect ; he states that the conditions for a perfect destructor are directly opposed to those required to obtain the maximum available calorific value of the burning refuse. He then gives data at some length for deducing such values as the average amount of refuse per head of population, and its calorific values; for the former he found 4 cwt. per annum a fair average, but for the calorific value the data vary very greatly and no mean can be given. He criticises a recent statement by Prof. Forbes, in which it is said that the "amount of refuse provided by any population is almost exactly as much as is required to supply the illumination by electric light of that same population," which, Mr. Tomlinson claims, is a mere scientific possibility, extremely remote, and cannot be realized at present at least. The paper, which appears to be the best compilation of the results that have been published, is of an entirely practical character, and is well worth the attention of those interested in this subject.

Municipal Ownership of Central Stations.—The Lond. "Elec. Rev.," Aug. 4, gives an editorial on this subject based on the recent paper by Mr. Hammond (see Digest Aug. 19); while praising the paper it does not agree entirely with the conclusions; among other things it states that the municipal supplies of gas and water differ from that of electricity, in that the former are not luxuries, while the latter is, and will remain so for the next few years at least (this may be the case in England, but in America we believe we have passed that stage, at least in most of the installations).

Five Wire Installation in Koenigsberg.—The "Elek. Zeit.," July 21, gives quite a complete description of this station, accompanied by 20 well selected cuts. This station is of interest, as it is one of only four stations in Europe in which this system is used (one of the others is near Vienna, one at Trient and one near Paris, all three of which were installed by Siemens & Halske); the present installation is the only one of the kind in Germany, and was installed by Naglo Bros. In general the system appears to consist of one set of batteries all in one series, the five line wires being connected to five successive points in the series, so that the potential between any two is 100 volts; the connection from each wire to the cells is arranged so that the number of cells between it and the next wire can be varied by cutting out or in one or more cells; the pressure wires, which are used to operate these automatic regulators, all lead through the regulators to the middle point of the battery, which is, therefore, common to all the station ends of the pressure wires. The lines are led underground in the form of bare wires on porcelain insulators in Monier conduits, in which case they may be increased in size at any future time by simply adding another wire; since this station was started, three years ago, not a single fault occurred in these mains; for less than 12 ampères in a building only two wires are used, for 12 to 24 ampères three wires, for 24 to 36 four, and for more than 36, five wires are run into a building. A diagram is given, showing the diagrammatic, as well as the complete connections at the switchboard of the station. To show the (absurd) degree to which some of the conditions in the specifications are carried in that country, it may be mentioned that the speed was required to be exactly 200 revolutions and that the constructor was required to furnish three characteristic curves of the dynamos, one for 199, another for 200 and another for 201 revolutions per minute (this was all the more absurd as these three characteristics do not differ from each other); subsequent tests showed that it was impossible to keep the steam engines down to a variation of .05 per cent. (by which 5 per cent. is what was probably meant). The capacity of the central station is about 13,000 ampères of 16 c. p. It is stated that this station has proved that the difficulties claimed in regulating this system do not exist, as they have all been overcome; the system of underground wires is stated to have been excellent in every respect, being also cheaper, besides being more reliable than other systems; its advantages are so great that it could be employed even if the price were greater.

Three-Phase Installation at Bockenheim.—"Elek. Echo," July 15 and 22, contains quite a full description, accompanied by six illustrations, of the plant in the town of Bockenheim (a suburb of Frankfort-o.-M.) started running some six months ago; one of the chief features was to supply power, and for this reason a three-phase system was adopted; in order to supply current for lighting, two small shunt machines are employed in addition, which charge accumulators during the day, from which the current is obtained during the night after 11 o'clock; the capacity of the batteries is 102 ampère hours; in addition to this there are several transformers of the motor-dynamo type, situated at the outer ends of the feeders which transform the three-phase alternating current into a continuous current; the mains thus supplied are also in connection with the direct current mains from the station, thus putting these distant transformers in parallel with the continuous current machines and accumulators at the station; small motors up to 3 h. p. are run from the continuous current circuits; the three-phase lines are installed for from 200 to 300 h. p. and the direct current lines for 2,000 lamps of 16 c. p.; at present there are installed 160 h. p. in motors and 600 lamps; there are two three-phase dynamos of about 100 kilowatts coupled directly to their engines and connected to the bus bars in parallel; they have 48 poles, the magnets rotate and the armatures are stationary; the open or star system of connection is used; the voltage at the dynamos is 80, which by means of transformers at the station is increased to 660, at which it is transmitted directly to the motors and motor-dynamo transformers. The cuts include an interior view, several diagrams of the circuits and external views of the dynamos and transformers.

The First Theatre Plant.—The Lond. "Elec.," July 28, refers briefly to the installation at the theatre at Brunn, which is one of the oldest continental electric light plants, having been started in 1882; this theatre claims the distinction of never having had a single gas jet burning within its walls, and probably is one of the first, if not the first theatre, to be lighted electrically. The dynamo is one of the old Edison type, having three parallel magnets, each of the four machines having an output of 20 kw.; only one of these has had to have a new commutator; during the eleven years there was only one breakdown, and that was due to the bursting of a water pipe; the contracting company was subject to a fine of about $120 for each breakdown; the theatre contains 1,446 glow lamps of 16 c. p., besides a few arc lamps and motors.

Light from Penny-in-the-Slot Meters.—According to the Lond. "Elec. Eng.," Aug. 25, a gas company is supplying gas to the poor by a meter so arranged that a quantity of about 26 to 27 feet is allowed to pass on the insertion of an English penny (2 cents) through the slot; this quantity is sufficient for about six hours' lighting of a single jet (the cost of gas in England is about half that in this country). It is suggested that if this is a success why might it not be so with electricity, even though there are a number of objections which do not apply to gas.

Omnibus Lighting.—The discussion between Mr. Freund and the Lond. "Elec. Eng." is continued in the issue of Aug. 11, but contains little of general interest.

Parson's Steam Turbine.—Prof. Ewing, in the Lond. "Elec.," Aug 4, calls attention to the fact that there is an error in a statement recently made in that journal (see Digest, Aug. 12), in which 27.6 pounds of water per electrical horse-power hour should read 27.7 pounds per kilowatt hour. He also gives a short table comparing the results which he obtained and those obtained by Mr. Kennedy; the latter obtained 20.3 pounds per electrical horse-power hour, while he obtained 21.2, showing a gain of 4 per cent. in Mr. Kennedy's tests.

Oil Engines.—The Lond. "Elec.," Aug. 11, gives the results of recent trials of a 6 h. p. "Trusty" engine. At full load the oil used per brake horse-power hour was .82 pound for half power it was 1.12 pounds, and when running light .82 pound per indicated horse power per hour; the oil used cost 8 cents per gallon, making the cost per indicated horse power per hour ⅛ cent.

Wind Power.—According to the Lond. "Elec.," Aug 25, it has been suggested to surround the windmills by strong towers for directing the wind on to the vanes by nozzles, as water is directed on to the buckets of a Pelton wheel.

Boiler Testing.—The Lond. "Elec.," Aug. 11, reprints an article on this subject from a forthcoming work by Messrs. Geipel & Kilgour.

WIRES, WIRING AND CONDUITS.

Fireproof Wire.—The Lond. "Elec.," Aug. 18, describes and illustrates the Smythe & Payne system, in which porcelain insulated beads are threaded on bare copper wires, and the beads enclosed in a protecting tube of metal, which serves as a mechanical and waterproof protection; cuts are given showing the beads, the method of making bends and T-joints; the system has been in use for several years in a number of buildings, and has been found to be effective. (It may be remembered that about 10 years ago a similar system, in which the enclosing tube was made of lead, was introduced in this country; it was exhibited at the Philadelphia exhibition in 1884).

TELEGRAPHY, TELEPHONY AND SIGNALS.

Hydrophone.—The Lond "Elec. Eng.," Aug. 11, describes this apparatus; it was devised by Mr. M'Evoy, its object being to report to a ship or a port the approach of a torpedo boat; it consists essentially of a transmitter and a receiver; the former is a large iron bell jar completely submerged, mouth downward, at a suitable distance from the port or fleet to be warned, and contains a volume of air in its upper portion, in which is a sensitive contact apparatus: this is connected by cable to the ship to be warned, where, on completion of the circuit a bell is rung or an electric lamp lighted; the vibration set up in the water by the torpedo boat is sufficient to operate the contact; it is at present undergoing a practical trial in the Solent.

Telephone Statistics.—The Lond. "Elec. Eng.," Aug. 11, gives some statistics taken from a French journal, showing the progress of telephone communication in Europe during the past eight or nine years; from this we take the following: Switzerland now has nearly 10,000 miles of telephone wires, and 10,000 subscribers, making 8,000,000 communications per annum; Belgium has 12,000 miles, and 6,000 subscribers, making 10,000,000 communications; Germany has 70,000, and 49,531 subscribers, making about 257,000,000 communications; France has now about 20,000 subscribers in the 112 towns which have exchanges.

Telephone in Scandinavia.—Norway and Sweden have granted the necessary funds to establish a connection between Stockholm and Christiania, a distance of 350 miles. A line connecting Denmark and Sweden is also to be constructed. The Swedish state telephones, it is stated, have put the state telegraphs in the shade, as far as cost of installation goes.

Long Distance Telephony.—The Lond. "Elec. Rev.," Aug. 18, calls attention to a paper on this subject by Prof. Perry in the August number of "Phil. Mag."; numerical results from mathematical investigations are given which are said to be instructive and to possess a permanent value.

Telephone at Glasgow.—The Lond. "Elec.," Aug. 11, gives the reports of a meeting to consider the proposed municipalization at Glasgow.

ELECTRO-CHEMISTRY.

Nature of Depolarizers.—The Lond. "Elec. Eng.," Aug. 25, reprints a Chem. Soc. paper by Mr. Armstrong, in which he discusses more particularly the double behavior of certain solutions upon electrolysis, as, for instance, sulphuric acid, which, besides yielding hydrogen and oxygen may, under certain conditions, give ozone, hydrogen peroxide and persulphuric acid.

Electrolytic Preparation of Zinc.—Messrs. Siemens & Halske, in a recent patent, state that by adding a halogen to a neutral or slightly acid solution, the zinc is deposited in a coherent form of bright, silvery appearance, instead of in the usual spongy condition: instead of a halogen a compound, which when reduced forms a halogen, may be used; among the substances to be added are, chlorine, bromine, iodine, a slightly acid solution of hypo-chlorite or hypo-bromite, passing chlorine or bromine vapors through the solution, etc.; only a small quantity is required, and it must be added repeatedly from time to time.

Electrical Extraction of Antimony.—In the Lond. "Elec. Rev.," Aug. 25, a brief summary is given of eight different methods for extracting antimony by the wet process, which are believed to come within the range of practical application, and among them are several electrical methods. The summary is taken from a paper by Mr. C. A. Hering, in Dingler's Journal, No. 286, p. 287.

Storage Batteries at the World's Fair.—The Lond. "Elec. Rev.," Aug. 18, contains a good illustrated description of the storage batteries at the World's Fair.

MISCELLANEOUS.

Electric Rock Drilling Machinery.—The Lond. "Elec.," Aug. 11, reprints in abstract a paper by Mr. Stevenson on this subject, in which he describes in detail an installation of electric drills used for some time past in ironstone mining in Cleveland. The drill is of the revolving type, and is operated by an electric motor geared to it by beveled gears; it is run at about 400 volts and develops about 6 h. p.; the installation described is a very complete one, with a system of wiring enabling the drills to be applied at any part of the mines. The writer states that it is his decided opinion, as the results of his practical experience, that for simplicity of working, ease of transport, speed and facility for extension, the electric drill has proved itself to be in advance of any other mechanical contrivance yet introduced. In conclusion he gives a table of the first costs, the holes drilled per hour, and the stone mined, for six of each different kinds of drills, including hand, compressed air, hydraulic, petroleum and electric drills, which show that, while the latter is among the most expensive in first cost, the holes drilled per hour are greater by about 25 per cent. over the best of the others, while the stone quarried is also greater.

Formation of Ozone.—In a recent Chemical Society paper by Messrs. Shenstone and Priest, reprinted in the Lond. "Elec. Rev.," Aug. 25, the authors give the results of determinations of the amount of ozone produced in an electrical generator of the Brodie pattern. Omitting the conditions, the results are briefly as follows: if the length of the discharge is not too short the maximum proportion of ozone is nearly independent of the voltage, provided it is between 33 and 69 electrostatic units; if the path of the discharge is very short the maximum proportion of ozone is inversely proportional to the voltage; a given percentage of ozone can be obtained more quickly by a high than by a low voltage; the ozone produced is less when the rapidity of the discharge is very great than when it is more moderate; the highest proportion of ozone can be obtained when the glass is very thin and the space between the two very narrow; a greater amount can be produced by an induction coil than by a Wimshurst or a Voss machine; they believe that the silent discharge acts by decomposing oxygen into its atoms which subsequently re-combine to form ozone, and that ozone is not formed by the direct action of the discharge.

Action of Electricity on Microbes.—According to the Lond. "Elec. Eng.," Aug. 11, Dr. d'Arsonval has extended his experiments on auto-conduction (see Digest, Aug. 5) to find the effect, if there is any, on microbes; the pyocyanique bacillus, whose habits are already well known, was chosen, and a culture was placed in the solenoid; it appears from the somewhat meagre and unsatisfactory description that the only effect produced is that its power of secreting pigments is thereby modified, or, in other words, that the chromogenitive power of bacillus has been effected; but the treatment does not seem to have affected its germinating properties.

Electric Eels.—The Lond. "Elec. Eng.," Aug. 4, gives a brief account of observations of electric eels at the London Zoological Gardens; the eel is about 4½ feet long, and weighed from 16 to 18 pounds; by grasping it with the hand and removing it from the water the shocks obtained were almost unbearable; the eel kills its food, consisting of small fishes, by means of its electrical discharge, one discharge being generally sufficient to kill a small fish if the latter is sufficiently near.

Lightning.—The Lond. "Elec.," Aug. 18, describes a peculiar case of a tree struck by lightning, in which the discharge divided in the tree and slotted a clean channel in the bark of uniform width and thickness, the width being about 1½ inches.

Exhibition Juries.—The Lond. "Elec. Rev.," Aug. 11 contains an editorial on this subject in which it suggests the complete abolition of the whole system of medals certificates and honorable mentions, and to let it give place to the merits of public opinion. It sympathizes with the expressions of Mr. Conrad Cooke in his recent letter to the London "Times." which it says is very moderately written, and certainly calls for some kind of explanation from the Chicago authorities: Mr Cooke was appointed as a judge in the electrical section but resigned.

The Art of Composing Engineering Specifications.—The Lond. "Elec.," Aug. 11, reprints an abstract of an article on this subject from the "Journal of Gas Lighting" based mainly on a recent address of Mr. Cooper to the students of the Rensselaer Polytechnic Institute.

Judging the Electrical Exhibits at the World's Fair.—III.

BY HERMANN S. HERING.

VI.—Dynamos and Motors in General

Owing to the lack of forethought, no tests of dynamos or motors were planned until late in the summer, and consequently no arrangements were made at the time of the installation of the exhibits with a view to facilitate experimental work upon them. No laboratory for testing these machines could have been equipped in the short time remaining, nor elaborate tests arranged at their present location. The original intention, early in the summer, was to have elaborate tests made of all kinds of electrical machinery, which should be the most complete ever made, and should furnish most valuable data; the reports were to be very carefully worked up and to become standards of reference for a long time to come. As it takes slightly longer to carry out such tests than to propose them, nothing of this kind will now be attempted. Instead, the input or output of the machines, the effectiveness of the work done by them, the speed of operation, and the regularity, etc., while performing their normal work will be measured with moderate accuracy, and the judgment of the examiners relied upon more than the figures.

The general plan of examining dynamos and motors pursued by the judges—which work is now well under way and will soon be completed—is about as follows:

(a) The mechanical and electrical workmanship is first examined and criticised.

(b) The machines are operated on their usual circuits, and the general effectiveness of performing their duty is noted.

(c) The load is then varied and the regulation of the machines tested; that is, their ability to hold the speed, current or potential, as the case may be.

(d) The claims of the exhibitors are then compared with the known performance of similar machines in general practice, and if found to differ widely the machines are subjected to the following tests:

(e) The efficiency of the machines at full and at half load.

(f) With arc lamp machines, the belt horse power, at full and half load, required to operate each arc lamp; with incandescent lamp machines, the number of 16-c. p. lamps operated per horse power at the belt, with the machines running at full and at half load. Normal arc lamps are assumed to require 300 watts per nominal 1,200-c. p. lamp, and 450 watts per nominal 2,000-c. p. lamp; and incandescent lamps, 56 watts per 16-c. p. lamp.

If the claims of the exhibitors agree fairly well with the known results of general practice, they will have considerable weight in deciding upon the award; otherwise the results of the tests will be used. Much weight will be given to the mechanical and electrical design and workmanship, though it will be difficult to establish a standard here owing to the different opinions, experience and standpoints of the designer and examiner.

VII.—Special Applications of Motors.

(a) *Electric Railways.*—In the case of exhibits arranged for operation and those in actual operation, the daily records for one month will be examined, and if not sufficient complete records will be taken for a period of time by the judges, or previous records of similar machines accepted for comparison if necessary. The special points desired in these records are the fuel and water consumption and continuous volt and ampere readings at the station; a continuous speed record of a car for a day; number of passengers carried; cost of operating station and cars per train mile and per ton mile; the delays due to derangement of machinery and the time lost therefrom; all this, if possible, to be compared with similar records of roads in actual operation. The special points to be determined by the tests, in addition to the efficiency under normal operation, are the time and power required for starting the cars, the regulation and the equivalent drawbar pull.

In the case of exhibits not arranged for trial the general plan given in VI. will be followed, and considerable weight given the known results of the actual operation of similar machines.

It is still planned to make an elaborate report upon railway motors, including much classified and tabulated matter, but appearances indicate that this will not be carried out.

(b) *Electric Launches.*—In addition to the examination of the launches in accordance with the general plan already given, a few rough tests were made of their performance.

Speed trials were made of the 36-foot and 33-foot launches, three trials of the former and four of the latter class, in the Grand Canal, between the Manufactures and Liberal Arts Building and the Electricity Building, over a course one-third of a mile long. Readings were taken of the speed of the launch, current and voltage at the motor, and the revolutions of the propeller.

It is to be regretted that more exhaustive tests were not made, because very little reliable data of the performance of electric launches is available.

(c) *Electric Elevators.*—There are a great variety of elevators exhibited, many being of widely different construction; the report of the judges upon the tests and their comparative performance will be awaited with interest. These tests have been completed.

In addition to the examination made according to the plan already given, the following were the essential points of the tests:

The elevators were loaded with a known weight, and operated first at full and then at half load; readings were taken of the current and pressure at the motors, while starting and while running steadily, and the mean speed determined from the time required to make the ascent. Consideration was given to general effectiveness of operation, simplicity, prompt starting, smooth running and the precautions taken to avoid accidents.

VIII.—Transformers.

For some strange and unaccountable reason transformers were placed in Group 122, Apparatus Illustrating the Phenomena and Laws of Electricity. Why they should be classed with apparatus for general demonstration any more than dynamos or motors, and added to the committee already overburdened with the tests of instruments of precision, resistances and commercial meters, it is not easy to explain. In order to meet this difficulty, several members of sub-committee No. 3 on Dynamos and Motors have been added to sub-committee No. 1 to conduct the transformer tests. Plans have not yet been definitely agreed upon, and the work of examination has not yet begun. Following is a brief outline of what the committee proposes to do:

(a) The mechanical and electrical design and construction will be examined and criticised; as also the character of the insulation.

(b) The transformers will be operated at no load, half load and full load, and the folowing determinations made:

(c) The watts lost when secondary is in open circuit.

(d) The regulation or drop at these three loads, by simultaneous readings taken of primary and secondary pressure.

(e) The efficiencies.

(f) The general effectiveness of the performance of the transformer and its appurtenances under these conditions.

(g) The resistances of the primary and secondary coils, while heated normally, will also be determined.

As in the examination of other apparatus, the claims made by the exhibitors will be given consideration.

Weston instruments and specially calibrated wattmeters will be used in making these tests.

IX.—Directly Coupled Engines and Dynamos.

The most novel, if not the most interesting, wil be the tests of the large directly coupled generators. Machines of this size and class have not before been tested by impartial experts, and the results will, therefore, be awaited with a great deal of interest.

According to a rule made by the Committee on Awards, the firms competing for awards were to share the expense of making the tests. This many of them have refused to do, and a great deal of confusion has resulted in consequence. The intention was to test five or six of the large directly coupled generators, for both engine and dynamo performance, efficiency and the various resistances, losses, etc. No very definite arrangements have yet been made.

(To be continued.)

The Great Search Light at the World's Fair.

The large General Electric search light was run for the first time on Thursday night, Sept. 7. It is located on the top of the Colonnade, at the south end of the South Canal, between Agricultural Building and Machinery Hall. The trial was very successful, and the General Electric Company is very much pleased. The brilliancy of the light was quite marked as the beam flashed across the Court of Honor, and suffered very little by comparison with the rest of the search lights and the grand illumination of the buildings. The General Electric Company expects to have the judges in electricity make a photometric measurement of this light. The power required at this test was about 180 amperes and 65 volts, which is less than the normal.

Annual Clambake of the American Electrical Works.

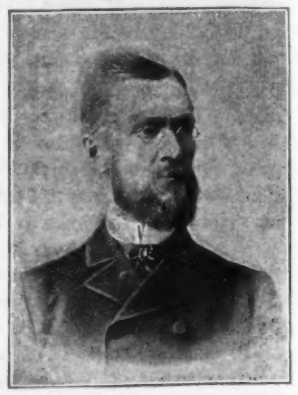
The fifteenth annual clambake tendered to the electrical fraternity by the American Electrical Works took place on Saturday, Sept. 2, at Haute Rieve, near Providence, R. I. As is customary on these occasions, those present had a most enjoyable time, every effort being made by President Phillips to contribute to the success of the gathering. The guests were transferred to Haute Rieve in special cars on the new electric road, and after a delightful lunch the usual sports furnished abundant amusement. After an excellent dinner the guests were called to order by Mr. C. E. Stump, who acted as toastmaster. Speeches were made by President Eugene Phillips and Messrs. M. C. Day, Frank Ridlon, H. M. Daggett, Wm. Brophy, W. S. Key and H. B. Cram.

On the Maximum Efficiency of Arc Lamps with Constant Watts.

BY PROF. H. S. CARHART, OF ANN ARBOR.

A paper presented to the Electrical Congress.

It is of interest to determine, in connection with the proposal to define a 2,000-c. p. arc light in terms of the watts expended on it, whether the illumination is independent of the current as a variable. If a 2,000-c. p. lamp shall be defined as one requiring 450 watts for its maintenance, shall the current be 10 amperes and the P. D. of the arc 45 volts, or will a smaller current and a higher voltage give higher illumination?



The present paper can be considered as describing only a single step toward the solution of the problem, or a preliminary note relating to experiments conducted under one set of conditions. It seems quite clear that with any definite number of watts the candle power will be a function of the current, the size and quality of the carbons, and perhaps also of the source of the current, whether from a constant potential circuit or from an open or a closed coil constant current machine. The experiments conducted by three of my pupils, Messrs. Raymond, Hookway and Fisher, have been confined to the circuit of a constant current dynamo with closed coil armature, and to soft, plain carbons 7-16 inch diameter, made by the Standard Carbon Company, of Cleveland.

The method employed was as follows: With any constant current within limits a series of measurements of candle power was made by changing the length of the arc and hence its P. D. A curve was then plotted with c. p. and volts as co-ordinates. Fifteen such curves were drawn for currents ranging between 6.75 and 10.75 amperes.

Then any number of watts was chosen, say 450, and this was divided in succession by the several currents used in obtaining data for the fifteen curves, or by so many of them as came within practical limits. With the potential differences obtained in this manner, and the corresponding candle powers read off from the several curves, another curve was constructed, with candle power and volts as co-ordinates and with the watts constant. Such curves show a maximum point

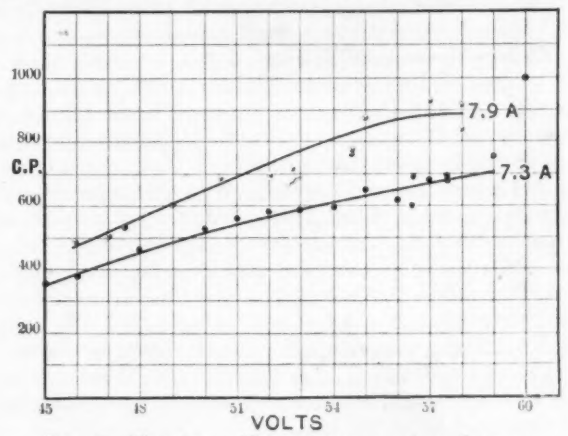


Fig. 1.—Maximum Efficiency of Arc Lamps.

corresponding to the volts at which the lamp gives the greatest candle power.

The measurements were all made in the photometric room with a 32-c. p. incandescent lamp as a standard of comparison. The arc lamp was mounted so that the arc was at the extremity of a radius of half a metre, movable about an axis parallel to the photometer bar. The end of this axis carried a plate glass mirror from which the light of the arc was reflected down along the bar to the photometer box. The arc or its image in the mirror was thus kept at a fixed distance from the incandescent lamp, and its position was always such that the light came from the arc at an elevation of 45 degrees. The absorption of the mirror was measured and found to be 8.7 per cent.

I have plotted only four of the fifteen curves composing the series. Fig. 1 contains two curves, with currents of 7.3 and 7.9 amperes, and Fig. 2 two others at 8.27 and 10.75 amperes respectively. It will be seen that a maximum of only a little over 1,100 candles was obtained. Fig. 3 contains the two curves derived from

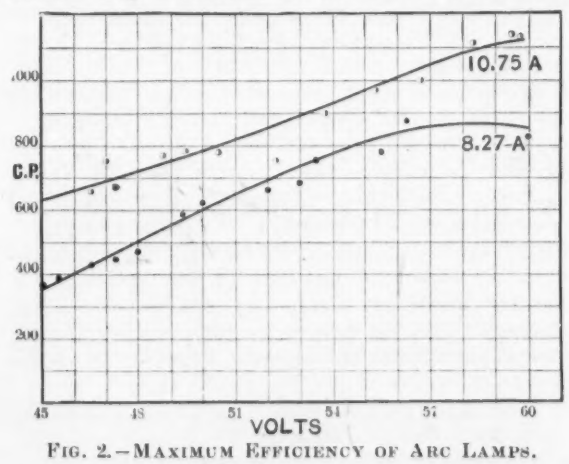


Fig. 2.—Maximum Efficiency of Arc Lamps.

all the data, and with constants of 450 and 500 watts respectively. Both show a pretty well defined maximum at about 54 and 55 volts respectively. Hence for a lamp of 450 watts the current should be about 8.4 amperes with the carbons described above. The candle power was then 900. At 10 amperes and 45 volts this curve shows the surprising fact that candle power was only 450.

With 500 watts the current rises to about 9 amperes

and the voltage to 55. I attach no great importance to these particular figures, but the series of experiments shows a very large variation of candle power, current and potential difference varying inversely, their product or the watts remaining constant. It is proposed to ex-

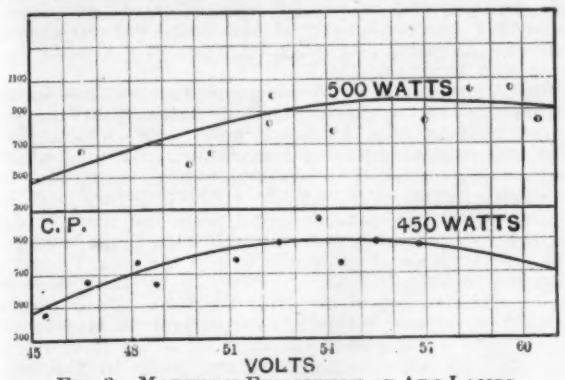


FIG. 3.—MAXIMUM EFFICIENCY OF ARC LAMPS.

tend the investigation to other carbons of different size and quality, and to currents of an open coil machine; but enough has already been done to show that the definition of a 2,000-c. p lamp as one on which 450 or 500 watts are expended is not so definitive or unobjectionable as might at first be supposed.

A Pair of Electrostatic Voltmeters.

BY PROF. H. S. CARHART, OF ANN ARBOR.

A paper presented to the Electrical Congress.

It is often desirable to be able to measure directly the potential difference between the primary wires of an alternator without recourse to a transformer or other auxiliary device. An electrostatic instrument is especially applicable to this purpose since it has no self-induction and takes no current. Such an instrument for laboratory purposes, which has proved exceedingly satisfactory, I have had made by my mechanician, Mr. Ralph Miller.

But another one capable of measuring from about 20 or 25 volts up to 100 is needed for the purpose of calibrating the first. This I have also designed and Mr. Miller has built with much skill.

Both of these instruments may very properly be called electrostatic dynamometers. Each contains a mirror from which a beam of light from a lamp is re-

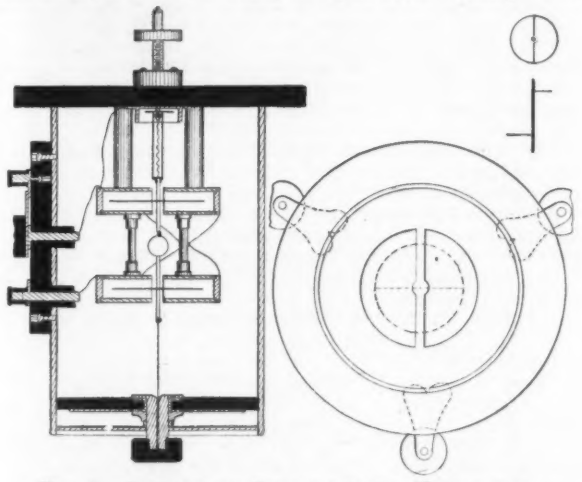


FIG. 1.—SECTION OF ELECTROSTATIC VOLTMETER.

flected to a fixed scale; and in using them the spot of light is brought back to the initial or zero position, by turning the torsion head before the reading is taken. The beam of light, some 40 inches in length, takes the place of the pointer of a Siemens dynamometer. In this particular I have followed Mr. Swinburne, but in most other respects the design differs from his. In fact, I had never seen a Swinburne voltmeter till after my first instrument was made, and my second one differs from his more than the first.

Referring to Fig. 1, which consists of a horizontal and a vertical section, it will be seen that the fixed portions of the electrical device consist of four half circular flat boxes, 3 inches in diameter and half an inch deep inside. The lower pair are supported on ebonite pillars, and the upper ones are supported from the lower by means of lead glass rods set into appropriate sockets. The needle consists of two half circles of very thin aluminium mounted on wire of the same metal, as shown in the small diagram in the lower left-hand corner of the figure. It is evident that when the half circles are cross-connected, as shown, and one pair of inductors is connected with the needle, the forces acting

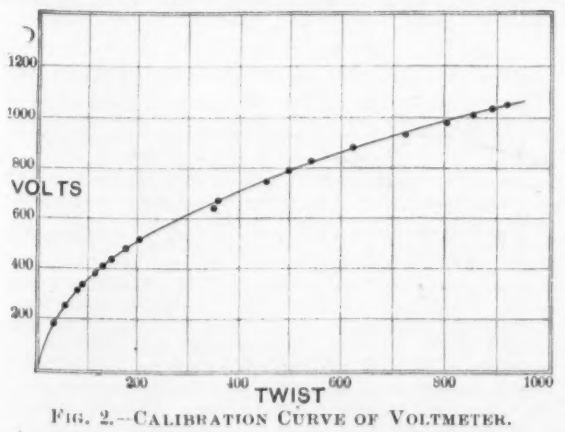


FIG. 2.—CALIBRATION CURVE OF VOLTMETER.

on the movable system are all such as to turn it in one direction. The needle is suspended by a phosphor-bronze wire about 0.0015 inch in diameter from a torsion head of brass with a hard rubber top. The hole through this brass head is larger than the drawing shows except at its upper end, so that the suspending wire is perfectly free except at its point of support. Below the axis of the needle is connected by means of a spiral of platinum-silver wire to the brass cup containing paraffine oil as a damper. The mirror hangs midway between the two half circles forming the needle.

To set up and adjust to zero without leaving the suspending wire under torsion, the bottom of the spiral below is left free. The torsion head is then turned till the spot of light comes to the zero of the scale. Then the brass cap on the lower end of the spiral is attached by friction to the pin in the brass cup, and the cup is turned till the spot of light again returns to zero. Both the upper and lower wires are then free from torsion.

The scale, resting on the hard rubber at the top, is divided into 400 equal divisions, and the pointer is set to the zero of this scale after the preceding adjustment has been made. Connections with the mains are made by means of the rubber covered binding posts, as shown, and the key, which is drawn in the charging position, is made to discharge the quadrants or inductors by turning through 180 degrees. The damper consists of a horizontal disc, supported by two wires from the axis of the needle, and having at its centre a hole through which passes the pin holding the spiral.

When the instrument is charged the system swings, twisting both the supporting wire and the steadying spiral at the bottom. The spiral has more torsion than the wire. The torsion head is turned till the spot of light returns to zero, and the twist of the suspending wire is then read by the pointer on the scale. The spiral below has no influence on this reading, since it is without torsion at the zero position, except in so far as the suspending wire shortens by the twist to which it is subjected. The instrument is practically dead beat and its performance is in every way most satisfactory.

Fig. 2 shows the calibration curve. Since the instrument is used idiostatically, this curve should be a parabola. It departs from a parabola only very slightly. The constant increases a little on the upper readings, probably because of the shortening of the suspending wire, as already explained.

The upper points of this curve were obtained by means of a platinoid resistance of 4,000 ohms, wound non-inductively on three frames supported in a horizontal position, so that all portions of the wire remain at the same temperature. This wire is divided into four sections, and the resistance of each section is carefully measured. The smallest is a little less than 1-10 of the entire amount. The whole is connected across the mains leading to the alternator, while conductors lead from the terminals of the smallest section to a Kelvin multicellular voltmeter. Successive readings were taken, while the voltage of the machine was made to vary by means of the resistance in the field of the exciter. For the lower points, which it was not practicable to reach

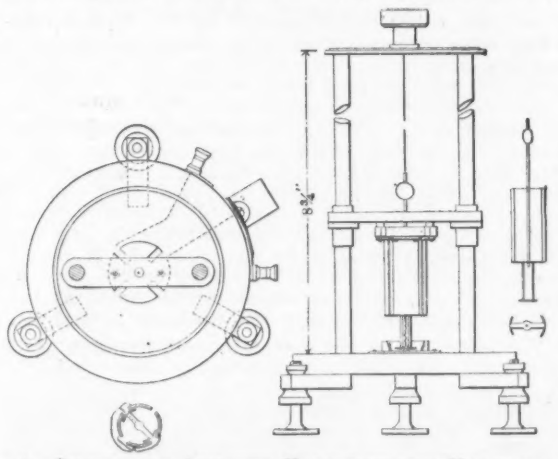


FIG. 3.—SECTION OF ANOTHER ELECTROSTATIC VOLTMETER.

by the alternator as above, recourse was had to a direct constant current dynamo and a Weston voltmeter with additional known resistance in series. This method was particularly satisfactory, and the regularity of the points obtained constitutes a fine testimonial for the Weston instrument, in comparison with the irregular nutation of the points secured by means of the Kelvin multicellular. It will be seen that 1,000 volts were measured by a twist of the suspending wire of about two and a quarter turns. No appreciable set was observed.

This same instrument has been used with success to obtain the curve of primary E. M. F. of the alternator, no other apparatus being required except the usual contact maker on the end of the dynamo shaft. The readings may be taken very quickly and conveniently.

The second instrument is shown in section in Fig. 3, the case being omitted. The sectors are cylindrical and are supported on a hard rubber head, which in turn is rigidly attached to a strap of hard rubber supported on two brass columns. These carry the divided scale at the top. The hard rubber head is slotted, as shown at the left, to increase insulation between the cylindrical sectors. The needle consists of two cylindrical sectors shown at the right. The damper is made in the same way as in the first instrument. The entire suspended

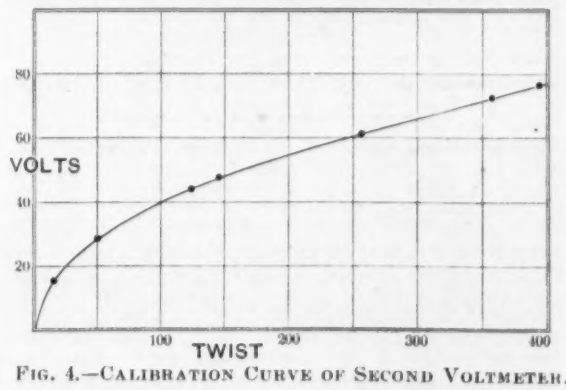


FIG. 4.—CALIBRATION CURVE OF SECOND VOLTMETER.

system in this case is aluminium, except the spiral at the bottom, which consists of a very thin phosphor-bronze strip, made by cooling on a mandrel, annealing and finally retempering. The suspension is made by means of a quartz fibre. A much finer fibre than the one used would carry the system, which weighs a little over one gramme. The adjustment to zero is made in the same manner as described in connection with the other instrument. This instrument is much more accessible for adjustments than the other, since the brass case can be removed without disturbing any of the parts. The cylindrical sectors are only an inch in diameter, the vertical adjustments are effected by sliding the supporting sleeves up or down on the posts, and the leveling screws are made so as to secure the instrument to the shelf on which it stands.

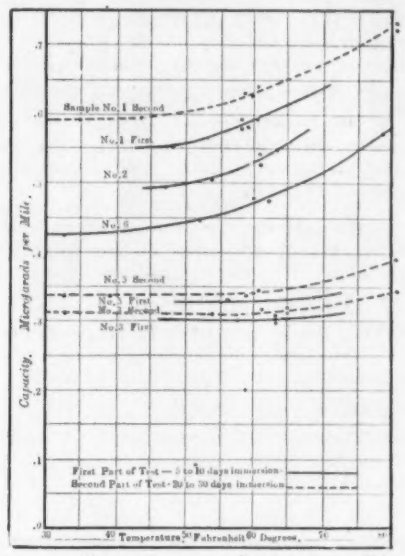
Fig. 4 is the calibration curve from about 16 to 76 volts. This was made with a temporary paper scale; and instead of lamp and concave mirror, which will be used finally as on the other instrument, a plain mirror and telescope were employed as a temporary expedient.

Note on the Variation of Capacity of Insulated Wires with Temperature.

BY HERMANN S. HERING.

A paper presented to the Electrical Congress.

While making some tests of insulated wire for the Chicago Electric Company, I determined the capacity, resistance and electrification at various temperatures, and found that there was a decided variation of the capacity with the temperature of the wires. The samples of wire tested were of Nos. 12 and 16 B. & S. gauge covered with vulcanized rubber, the patented process of this company, and invented by Mr. H. B. Cobb, of Wilmington, Del. The radial thickness of the insulation was about 1-16 inch. In two of the samples


Sample No. 1 Second
No. 1 First
No. 2
No. 6
No. 3 Second
No. 5 First
No. 5 Second
No. 3 First
Capacity. Microfarads per Mile.
First Part of Test — 5 to 10 days immersion.
Second Part of Test - 20 to 30 days immersion.
Temperature Fahrenheit Degrees.

VARIATION OF CAPACITY OF INSULATED WIRES WITH TEMPERATURE.

furnished, Nos. 3 and 5, the insulation was loose upon the wire, and in Nos. 1, 2 and 6 it was tight.

By referring to the diagram it will be observed that the curves are distinct and have a definite shape, and that there is a decided increase of capacity within the usual ranges of temperature met in practice.

All the tests were made in the same manner, with the same instruments and with all possible errors eliminated. Readings were taken after the wire had been charged 20 seconds. The curves represented by solid lines were made during an immersion of the wire of from 5 to 10 days. Those represented by broken lines were made after an immersion of from 20 to 30 days. It will be observed also that the capacity increased slightly with the length of immersion, and that samples Nos. 3 and 5, whose insulation was loose, not only had a smaller capacity per mile than samples Nos. 1, 2 and 6, whose insulation was tight, but also had less variation within the same ranges of temperature.

The cause of this increase of capacity with the increase of temperature is not easily explained unless the expansion and contraction of the insulation acts inwardly as well as outwardly, but yet that does not offer an entire explanation. I thought at least that the results would be interesting, notwithstanding that I had no satisfactory theory with which to explain them.

On the Swinburne-Thompson Unit of Light.

BY SILVANUS P. THOMPSON, D. SC., F. R. S.

A paper presented to the Electrical Congress.

In the spring of 1892 it was independently proposed by Mr. James Swinburne and by the author of this note to adopt as a unit of light of standard quality the light emitted from a unit of area of the positive or crater surface of the electric arc formed between electrodes of pure carbon.

The advantages of this source of standard of illumination over all flame standards hitherto proposed are so obvious as scarcely to need mention.

The advantages over the platinum or Violle unit are also considerable. The carbon arc is much more easily managed, and if a pure carbon is employed it is much more reliable as a standard than the mass of molten platinum.

The light of the electric arc is emitted, as is well known, chiefly from the end of the positive carbon, very little proceeding from the flame itself, and not much from the negative tip. The positive carbon is, in fact, heated intensely hot over a patch, from which the column of conducting vapor or flame (called by Davy the "arc") is projected across to the tip of the negative carbon. This luminous patch becomes hollowed out into a crater, white hot all over its surface except at the edges, which are duller and redder, and which volatilize much less, but consume slowly by oxidation when the arc is produced in air. Except at these edge parts, the light of the crater surface is of uniform lightness at every part of the carbon if the carbon be pure. The reason of this circumstance is, as pointed out years ago by the writer, that carbon has a fixed temperature of volatilization. The arc cannot be formed at all unless this temperature is reached at least at some portion of the surface; and the temperature cannot be exceeded at any point, simply because the volatilization of the carbon keeps it down. The temperature of the crater surface—that is to say, the tempera-

ture of the volatilization of carbon—is as definite (if the material is pure and the external pressure constant) as is the temperature of the melting point of ice, or as that of the boiling point of water. It appears to be about 3,500° C. All arcs are made with a pure carbon, emit from the crater (save as regards the marginal parts) a light of equal whiteness, irrespective of the strength of current, or of the voltage, or of the length of the arc. Any variations that are noticed in the apparent colors of arc lamps arise either from the semi-incandescent parts around the edge of the crater or from the tip of the negative carbon, or from the flame itself. If an arc has been burning for some time, with a certain current—say 6 amperes—its crater will have assumed a certain shape or size. If we now increase the current to 12 amperes the incandescent surface of the positive carbon will be at once increased in proportion, save for a slight discrepancy arising from the marginal effect of the duller parts, and the enlarged crater will settle down to a new shape. (These remarks relate to the steady arc, the phenomenon of the hissing arc being still very obscure.) If, then, by proper shielding there can be cut off all the stray light of uncertain quality emitted by the red-hot margin of the crater, that emitted by the negative tip and by the flame, so that only the true crater surface is visible, its whiteness, as so viewed through a hole in a suitable diaphragm, will always be of the same unvarying quality. This was the discovery of Captain Abney, F. R. S., in 1878; and it forms the basis of all the splendid work done by him in conjunction with Major-General Ferting, F. R. S., on the photometry of color.

Increasing the current merely increases the size of the crater, but does not alter its intrinsic brilliancy or its color. Increasing the voltage of the arc has no effect on the intrinsic brilliancy or color of the true crater surface. Increasing the length of the arc has no effect on the intrinsic brilliancy or color of the true crater. The amount of light emitted from a square millimetre of crater surface is a fixed quantity, no matter how the current, or the voltage, or the length may be varied; and not only is the total amount of light emitted from a square millimetre constant, but its composition is constant. That is to say, the proportion relatively of red waves to blue waves is the same always, independent of current, voltage or length of arc.

It was in consequence of the recognition of these physical properties of the true crater surface that the writer and Mr. Swinburne each made the proposition for the establishment of a new unit to supersede the Violle standard.

Since that suggestion was placed before the scientific world some work has been done toward its realization. In France M. Blondel has described under the term "arc normal" an apparatus closely resembling that used by Abney in his photometric researches, consisting of an electric arc furnished with a metallic diaphragm pierced with an aperture of known dimensions, but with the addition of a water-cooling arrangement. More recently M. Violle has taken up the subject of the electric arc, and has redetermined the temperature of the crater. He adopts and confirms the author's view, that this temperature is determined by the volatilization of carbon. The author has also recently investigated the possible errors introduced by the thickness of the diaphragm and by an obliquity in its position; he has found these sources of error to be by no means negligible. He has also made some experiments on the purity of carbons, and finds that natural graphites always give a less light intrinsically than the artificially prepared hard carbons. Trotter, in his original investigation of the distribution of light as emitted from the arc lamp, announced the different emissivity of the soft carbons used for cores. He also investigated the amount of light emitted (normally) from a square centimetre of hard carbon, and finds it to be something less than 70 candles, or about 7¼ carcels. Doubtless the imperfections of the photometric methods until recent years were such that the production of an exact standard of white light was of less importance than is now the case, since photometry has become an art of precision. Prof. Ayrton, adopting the periodic principle of photometry lately described by the author, and using a photometric screen of the Lummer-Brodhun pattern, finds no difficulty in measuring light with a precision of one part in 500. Now that such accuracy of measurement is possible, there is the more urgency for adopting a standard which is not only of entire trustworthiness, but is also easily reproduced.

A Rotary Mercurial Air Pump.

BY DR. F. SCHULZE-BERGE.

Abstract of a paper presented to the Electrical Congres .

The pump vessel is formed by a curved tube returning into itself, which revolves in constant direction around a stationary axis of rotation. A mercury piston passing through the interior of the tube creates on the one hand the vacuum, and expels on the other hand the air, while the connections required of the pump vessel with the receiver and the atmosphere are effected by stopcocks or suitable valves.

Of the numerous modifications which may be given to the apparatus on this principle, a detailed description is given of the one which has proved to be the most serviceable for practical use.

The greatest difficulty met with in the production of high vacua by rotary air pumps is caused by the necessity of establishing an absolutely and permanently air-tight joint between the rotary and the stationary parts of the pump. Without doubt this is the principal reason why the practical development and application of rotary pumps have not been carried out so far. It is impossible to create and maintain a high vacuum according to the notions of this day without a connection warranting perfect airtightness between the receiver and the rotary parts of the apparatus. If, on the other hand, the receiver were to be rigidly connected with the pump, it would have to participate in the rotation of the latter, which only in rare cases would be practical and recommendable.

This pump, illustrated by Figs. 1 and 2, is distinguished by its easy manipulation, quickness of work and reliability of action, and appears equally adapted for laboratory work as for industrial purposes.

Also this apparatus is supposed to co-operate with an auxiliary pump, which is used to create a moderate preliminary vacuum.

To facilitate the general view of the instrument, only one of the two ring shaped pump vessels is shown in Fig. 1.

First the arrangement of the axle is to be considered. It consists of two concentric tubes, A_1 and A_2. The larger tube, A_1, is mounted rotatably in the bearings L_1 and L_2, has an inclination of 45 degrees toward the horizon, and projects with its lower end into the stationary stuffing box S. Through the bottom of S a tube R is introduced airtightly. The same is surrounded by the wider tube R_1 as by a bell, the mouth of which is turned upward. The intermediate space between R and R_1 is provided with mercury. Into this space dips the inner axial tube A_2, which passes airtightly through the closed upper end of the tube A_1 and rotates simultaneously with this tube. The tube R is to be connected with the receiver; tube R_2 with the auxiliary pump.

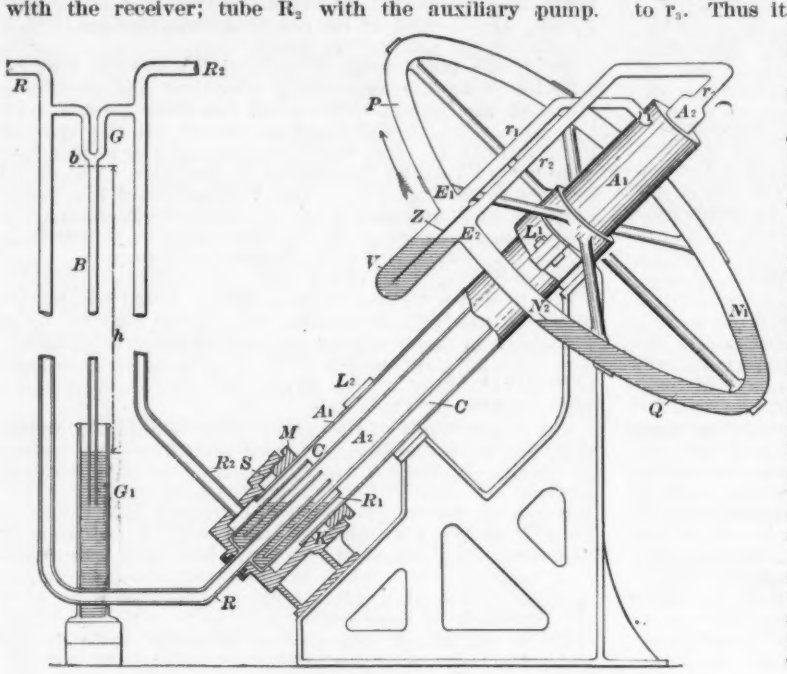


FIG. 1.—A ROTARY MERCURIAL AIR PUMP.

These two tubes are connected by the forked tube G, which is so arranged that (after the vacuum is created) mercury may be introduced into the fork or withdrawn from the sume by raising or lowering the vessle G_1.

The ringlike pump vessel P is fastened to the axle by six radial arms, and has an inclination of 45 degrees toward the horizon. Into the circumference of the ring the valve V is inserted. It essentially consists of a cylindrical vessel closed at the bottom and parallel to the axle of rotation, which vessel is divided into two compartments by a tongue Z reaching nearly to the bottom of the valve. One of these compartments is connected to the middle tube A_2 of the axle by tube r_2, while the second compartment communicates with the hollow space C contained between the walls of A_1 and A_2.

The valve V and about one-third of the circumference of the ring are filled with mercury, as illustrated by Fig. 1. If the ring is rotated in the direction of the arrow, the air contained above the mercury level N_1 is expelled through the tube r_1 and the channel C to tube R_2. At the same time air is drawn in the rear of level N_2 through the tubes r_2, A_2 and R into the pump vessel.

Let the receiver now be connected to R, and the ring vessel be placed in the position shown in Fig. 1, so that the tube r_1 may freely communicate with the interior of the ring.

First the auxiliary pump is worked, and the interior of the receiver and of the ring pump evacuated to such a degree as the auxiliary pump may be able to produce, say, for instance, to 10 millimetres of mercury pressure.

During this time the mercury rises in the barometric tube B, say, to point b. Now vessel G_1 is raised so as to make the mercury enter the fork G, thus interrupting the communication between R and R_2.

The level of the mercury contained between R_1 and R has not been changed by the preliminary evacuation, since so far the same pressure is acting within A_2 as in C.

If now the ring be rotated, air is drawn, by the action of the mercury piston explained above, from the receive.' into the ring through R, A_2 and r_2. On the other hand, the air contained in the ring above N_1 is expelled toward the auxiliary pump through r_1, C and R_2, while the mercury contained in V permanently prevents a direct communication between the ends E_1 and E_2 of the ring.

The auxiliary pump now is only worked to the extent required for removing the air discharged from the ring, and to maintain in R_2 and the parts connectinw with this tube the pressure originally created therein.

With each revolution of the ring the pressure decreases in A_2, while between A_2 and A_1 it remains essentially constant. Therefore the level of the mercury contained between A_2 and R will rise, while the level of the mercury between A_2 and R_1 must sink. The difference in level thus produced cannot become greater than the one corresponding in the difference of pressure between the preliminary vacuum created by the auxiliary pump and an absolute vacuum, i. e., not greater than 10 millimetres in the present case.

Of course the difference of pressure between the preliminary and the final vacuum is also manifested in the shanks of fork G, thus permitting the observer to watch the progress of the evacuation until the increase of the difference in level becomes inappreciable. For further observation a McLeod gauge is connected to R.

The stuffing box S only serves to protect the preliminary vacuum against access of atmospheric pressure, so far as required. The purpose is attained by a number of greased leather washers K inserted into the stuffing box, which can be compressed by the nutscrew M.

The separation of the final vacuum from the preliminary one is effected by the mercury contained between R_1 and R, and is accomplished thereby in a highly satisfactory manner. Even with the highest vacua attainable the seal proves absolutely reliable.

A seal based on the same principle may be used instead of the stuffing box S to separate the preliminary vacuum from the atmosphere. We have carried out this arrangement in several apparatus. It requires a somewhat greater length of the axle, but does away with the necessity of paying attention to a stuffing box, as in Fig. 1.

The pump which we found to be the best among the various apparatus constructed deviates from the one represented by Fig. 1 in one point only, which, however, is of great practical importance. Instead of the single pump vessel P it contains two of them, viz., the concentric rings P_1 and P_2 (Fig. 2). They are so arranged that the air evacuated from the receiver during the rotation must pass through both rings in succession. First, it enters through r_2 into the ring P_2 and is expelled (during the next revolution) by the piston Q_2 to r_3. Thus it enters the ring P_1, from which (during the following revolution) it is removed by piston Q_1 to r_1. Thence it is drawn off by the auxiliary pump in the same manner, as in Fig. 1.

The vacuum created in P_1 in the rear of N_4 improves with each revolution. The consequence is that, after the pump has been running for a short time, the air withdrawn from the receiver by P_2 is discharged into a space already highly evacuated, viz., into the vacuum of ring P_1. The whole volume of ring P_2, and the mercury contained therein, will therefore come into contact only with air of high rarefaction, which circumstance is of great importance if extreme evacuation is aimed at.

The pump does not require any manipulation except a simple rotation. It, therefore, can be easily run by machinery. For that purpose there is a space provided on the axle for a pulley. For rotating the apparatus by hand, wooden handles are used, forming prolongations of the six spokes of the frame.

By this pump vacua of so high a degree as to escape close measurement by the McLeod gauge have often been created. For that purpose, of course, it is necessary to provide for the absolute dryness of the mercury and of all parts of the pump and the receiver.

As drying material in producing high evacuation we have used metallic sodium with good success. It eagerly absorbs humidity, and while giving off hydrogen, is covered with a layer of caustic soda. As the latter is highly hygroscopical, it adds efficiently to the drying action of the metal.

The vessel containing the sodium was, as a rule, connected to the rest of the system by a tube susceptible of being closed by a mercury seal.

A pump of the kind described, in which the outer ring had a diameter of 60 centimetres and a capacity of 0.9 litre, permitted 15 revolutions per minute when rotated by hand. At present a larger machine for industrial purposes is in course of construction, in which the volume of the outer ring amounts to 8.5 litres.

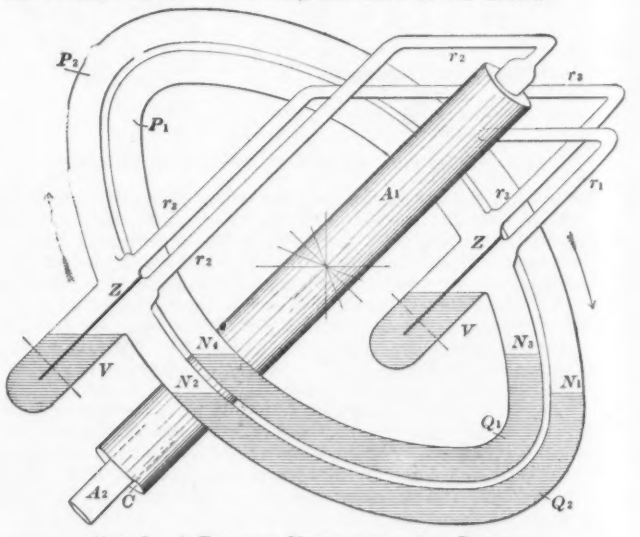


FIG. 2.—A ROTARY MERCURIAL AIR PUMP.

In conclusion, I wish to remark that besides the apparatus described quite a number of different modifications of the pump have been worked out, every one having its peculiar merits or advantages.

Various Uses of the Electrostatic Voltmeter.

BY DR. J. SAHULKA.

Abstract of a paper presented to the Electrical Congress.

The author refers to the advantages of electrostatic voltmeters for measurements of alternating currents, and points out that they require almost no current, the readings are uninfluenced by temperature and by the neighborhood of magnetic bodies, and by inclosing the electrostatic voltmeter in a metallic shell it cannot be influenced by electric bodies in the neighborhood.

The capacity of a Kelvin multicellular voltmeter, and the amount of current used by it, were determined for a case where the E. M. F. was 210 volts and the frequency 2,500 per minute. The potential difference e between the terminals of a transformer was measured with the voltmeter alone, and afterward a large graphite resistance r, having no capacity and no self-induction, was connected in series with the instrument, the voltmeter then indicating a smaller potential-difference e_1. As the voltmeter is a small air condenser, the phase of the potential difference e_1 corresponding to the same must be 90 degrees behind the phase of the charging current c; while the potential difference e_2 corresponding to the resistance r, coincides in phase with the current c. We have, therefore,

$$c = \sqrt{e^2 + e^2};$$

e and e_1 being known, e_2 can be determined, and we have for the charging current

$$c = \frac{e_2}{r}.$$

If the number n of periods per second is known, we can also determine the capacity K of the voltmeter, from the equation

$$c = 2 \pi n e_1 K.$$

With a voltage of about 208 and a frequency of 2,500 per minute, the results in the following table were obtained. The values in the column r are given in megohms, the values of e, e_1, e_2 in volts; the unit c is one-millionth of an ampere; the unit of K is one-millionth of a microfarad. In the last column r_1 are given the relative impedances of the voltmeter expressed in megohms.

TABLE I.

r.	e	e_1.	e_2.	c.	K.	r_1.
11.05	207.2	195.3	69.2	6.26	122	31.2
20.78	207.6	177.1	108.4	5 21	1 2	34.0
33.16	207.6	154.6	138 6	4 18	103	37.0
41.90	207.9	140.3	153.1	3.66	99.6	38.3
52.40	208.0	124 4	166 7	3.18	97.6	39.1

The capacity is greater for higher values of e_1 than for lower values, as the movable system of the voltmeter is more deflected toward the fixed system. If there is no potential difference between the terminals of the instrument, its capacity has its smallest value. Should the instrument be arranged in such a way that the movable system would always be brought back to its zero position by the aid of a torsion head, then the capacity of the instrument would be constant, the scale could then be spread over the whole circumference, while in the present shape the deflection is always less than 90 degrees.

If a diagram were plotted for an electrostatic voltmeter, the instrument could be used for measuring great resistances which have no capacity and self-induction, and are of the same range as the impedance of the instrument. As the alternating current which traverses an electrostatic voltmeter is exceedingly small, this instrument might be usefully employed for an indirect measurement of the intensity of the magnetic field of converters or electromagnets, which are excited by alternating currents. It is only necessary to wind around the core a sufficient number of turns of thin wire, and to connect its ends with the voltmeter. As the instrument requires almost no current, the magnetic field of the core is not influenced by measuring it with the voltmeter.

The electrostatic voltmeter can also be applied very usefully for measuring the capacity of condensers which are inserted in an alternating current circuit, and this question is gone into at great length, the results of measurements given in tabulated form, and the important conclusion arrived at that condensers with a solid dielectric have a smaller capacity when placed in an alternating current circuit than when they are charged with a continuous current electromotive force. Only the air condensers will not show such a difference. The cause of this remarkable fact is to be found in the behavior of the dielectric. The dielectric absorbs, in spite of its great ohmic resistance, a certain amount of electric energy during the charging process. During the discharge a part of this energy is given back, the other part has been changed into heat. Therefore we get, when connecting a condenser with a direct current electromotive force, a too great deflection of the galvanometer needle, as we measure not only the electricity which is stored in the sheets of the condenser, but also the electricity absorbed by the dielectric. In the same way we get a too great deflection of the galvanometer needle when discharging the condenser, as the dielectric gives back a certain amount of the absorbed energy. When using alternating currents the charge and discharge are finished in a very short time, namely, in the half part of a period. The dielectric has not sufficient time to absorb so much energy, as when connected with a continuous current electromotive force of the same size. During the discharge it gives back, therefore, also less electrical energy. That is the reason why the condensers have a smaller capacity when inserted in an alternating current circuit. The capacity will also be influenced by the number of full periods per second.

NEW BOOK.

NOTES ON RECENT RESEARCHES IN ELECTRICITY AND MAGNETISM, INTENDED AS A SEQUEL TO PROF. CLERK-MAXWELL'S TREATISE ON ELECTRICITY AND MAGNETISM. By J. J. Thomson, M. A., F. R. S. Oxford : The Clarendon Press. 1893. 578 pages; 144 illustrations. Price $4.00.

This volume may be considered as a sequel to Clerk-Maxwell's "Electricity and Magnetism," bringing the same up to date. The notation, type and arrangement have been maintained in conformity with Maxwell's famous treatise.

The first chapter is devoted to the suggestion of a theory of electricity and magnetism which is a departure from existing hypotheses. Maxwell and Lodge have postulated a particular structure in the ether, and have endeavored to account for the transmission of electro-magnetic effects by the relative motion of the parts in this structure. In this new theory, the ether may be a homogeneous fluid, in which free entities called "Faraday tubes" reside. These possess direction, momentum when in motion, and occupy space. It is shown that the motion of these tubes in space under certain assumed conditions can account for observed electro-magnetic action.

This theory is certainly more flexible than Maxwell's "idle wheel" ether, but it is on the other hand more complex in its attendant consequences. The latter has its limitations set by homogeneity; the former operates in virtue of, but under the complications of, heterogeneity. Thus on page 42 it is pointed out that according to the new theory the transmission of light through space may be regarded as the transmission of Faraday tubes through ether at the velocity of light. In this case either the same "tubes" move forward in the path of a luminous ray, or the forward motion must be communicated from arrested "tubes" to others lying in the line of advance. In either case the difficulties appear to be considerable. We are reverting from the existing theory of light propagation by elastic displacement toward the earlier Newtonian theory of luminous emission.

It is interesting to note that up to page 44 the arguments adduced in establishment of the theory involve no specific qualities for "Faraday tubes" other than entities occupying space, possessing direction or polarity, capable of motion and of communicating momentum. In fact the "tubes" might apparently serve the purpose of the theory up to that point, and the mathematical conditions, if they were non-gravitating molecules of ordinary matter possessing polar or directive properties. The specific properties of "Faraday tubes" as long, vortex-like bodies appear to be requisite at a later stage, in order to comply with some observed conditions of electrostatic and electrolytic phenomena.

Chapter II gives an excellent review of the knowledge that has been gained concerning the passage of electricity through gases.

Chapter III. states and illustrates an important theorem for determining the distribution of electricity on electrified plane surfaces in two dimensions. Hitherto such distributions in two dimensions have only been determinable by tentative processes or instinctive intuition.

The latter part of the book is devoted to electro-magnetic waves, oscillations and other motions. The treatment is mathematical, and masterly in character, but the Cartesian methods adopted throughout illustrate by contrast the advantage of the more recent vector analysis. Thus Poynting's theorem, which at Par. 280 occupies nearly four pages of proof in long equations of Cartesian triple integrals, is demonstrated no less rigorously in a few vector equations of the simplest type by Oliver Heavyside, at page 174, Vol. II., of his Reprinted Papers.

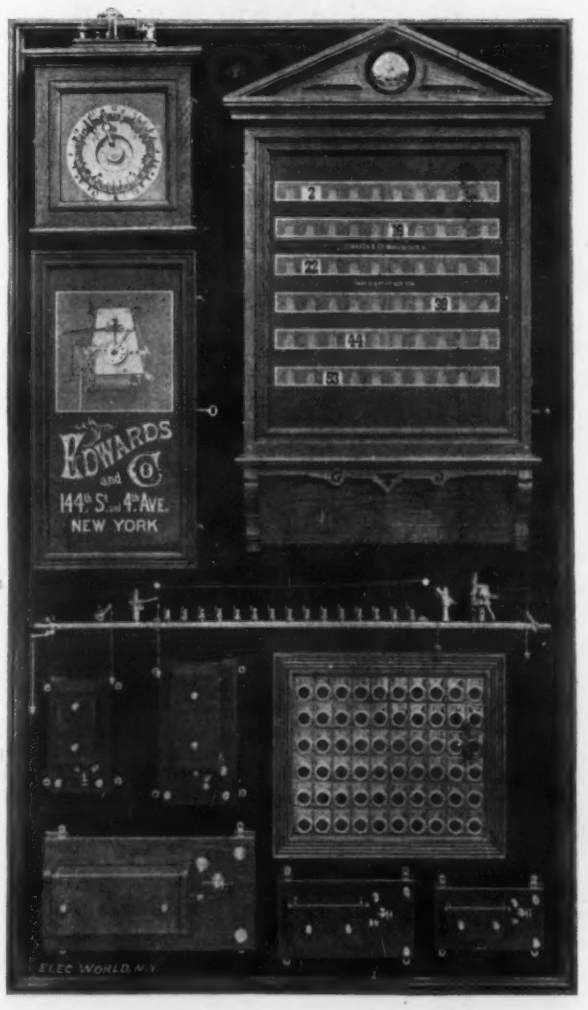
The book is notable for the fact that it is apparently the first to discuss purely optical phenomena by purely electrical methods. It is largely addressed to advanced students in mathematical language, but contains much that can instruct and interest those who are not conversant with symbolic forms of expression. A. E. K.

Grounding Transformers.

Electrical Insurance Inspector W. E. J. Deming, as the result of investigation into the death of a man from an electric shock at Lowry Hill, and subsequent experiments in an electrical laboratory, has, it is reported, had an order issued by the underwriters' association with which he is connected requiring transformers to be supplied with safe ground wires.

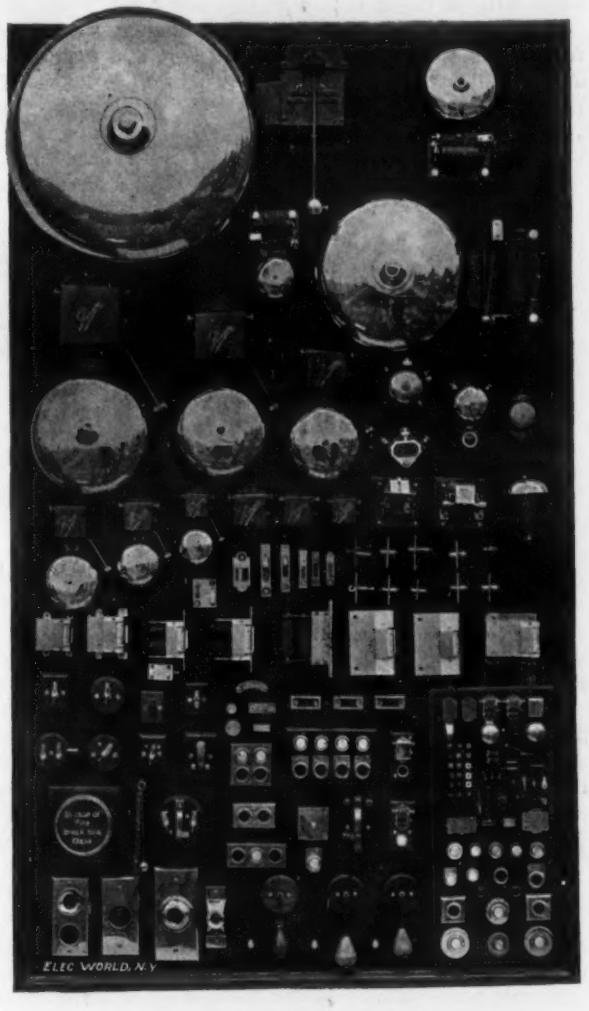
A Handsome Collection of Specialties.

One of the interesting features of the World's Fair exhibit of the Ansonia Electric Company, which was so



A HANDSOME COLLECTION OF SPECIALTIES.

elaborately described in The Electrical World of July 29, 1893, is the collection of the various specialities of Edwards & Co., Fourth avenue and 144th street, New York City. These are handsomely mounted on boards, and give a good idea of the excellent workmanship and good material and fine finish which are embodied in the products of Edwards & Co. In the accompanying illustrations two of these boards are shown, on one of which will be observed the type of bell described in The Electrical World of July 29. Perhaps it was not brought out as clearly as the importance of the case required



A HANDSOME COLLECTION OF SPECIALTIES.

that this is primarily a single stroke bell with an arrangement for giving a pendulum or vibratory motion to the hammer if desired.

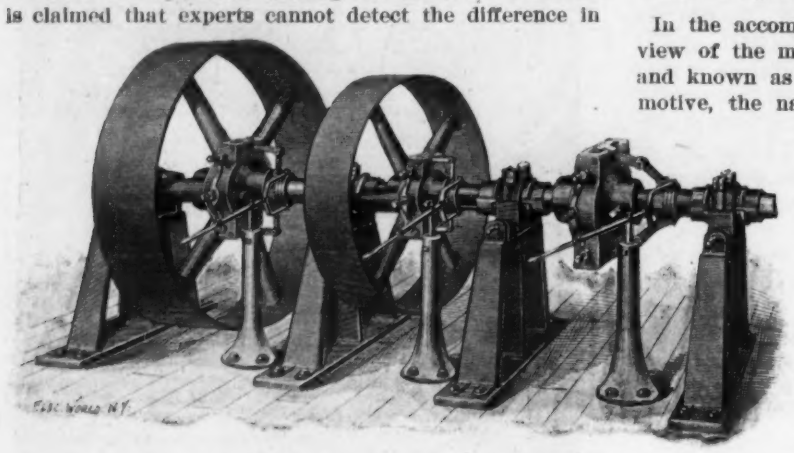
The Phœnix Lamp.

As we have pointed out before, the renewed attention given to the principles of incandescent lamps through the confirmation by the courts of the monopoly of the original form has resulted in improvements that otherwise would, perhaps, have been delayed indefinitely. The new lamp which we illustrate, manufactured by Wm. C. Callman & Company, 136 Liberty street, New York, has several features of interest, and the makers claim that it embodies many improvements over the older forms of lamps. The filament is made neither by the flashing process nor of carbonized vegetable fibre, but by a process long popular in Europe and only recently introduced on this side. Recent French decisions, it is claimed, have held that the process in question is not an infringement upon the Edison filament. Treated filaments are often of a smooth exterior finish, but defects exist below the surface; in the Phoenix filament, the filament is extremely dense throughout, resembling more a metal wire in appearance than a carbon thread, and unites toughness with great elasticity.

THE PHŒNIX LAMP.

The lamp is made in the latest popular form with coiled filament, bringing the light nearer to where it should be in all voltages over 65. The bulb is gas-filled with a vapor of recent discovery, by which the candle power, instead of diminishing, is slightly increased for the first half of the life of the lamp, and then drops to about 15 c. p., after burning 800 to 1,000 hours. It is claimed that experts cannot detect the difference in candle power between an old and a new lamp. As no vacuum is employed, the lamp does not infringe the Edison patents, it is claimed.

The lamp is made in all candle powers from 10 to 200 and of an efficiency of 3, 3½ or 4 watts per candle as desired. The manufacturers make a new departure by giving a written guarantee of life to large consumers.



THE HUB FRICTION CLUTCH PULLEY.

The Hub Friction Clutch Pulley.

The principle of the clutch we illustrate, which is manufactured by the James Smith Woolen Machinery Company, 411 Race street, Philadelphia, for electric light and power plants, lies in the system of levers used in connection with a friction band brake.

There are two sets of levers with a wedge and toggle movement; these give such a powerful grip that a hub of smaller diameter than usual, with proportionate small width of face, is used. The face of the male hub contains wooden dovetailed insets, making the best surface for clutching.

The friction surfaces travel at a lower rate of speed than when the grip is on an extended arm, and are subject to an equal amount of pressure and friction at all points of contacts. There is no unequal speed and grinding action, and this, with the provision for regular lubrication for the surfaces, makes the clutch unusually durable.

The clutches are made in sizes up to 1,000 h. p. and to run 1,000 revolutions per minute. The cut shows a complete shafting outfit with friction clutch pulleys, cut-off coupling, chain oiling ball and socket bearings, mounted on cast iron floor stands provided with vertical and lateral adjustments.

An Upright Gang Drill.

We illustrate herewith an upright gang drill of improved design, recently placed on the market by the Pratt & Whitney Company, of Hartford, Conn. The essential features are the same as in all drills of this class, but the improvements embodied in this design will be readily appreciated by mechanics and others who may have experienced the disadvantages of the old style gang drills.

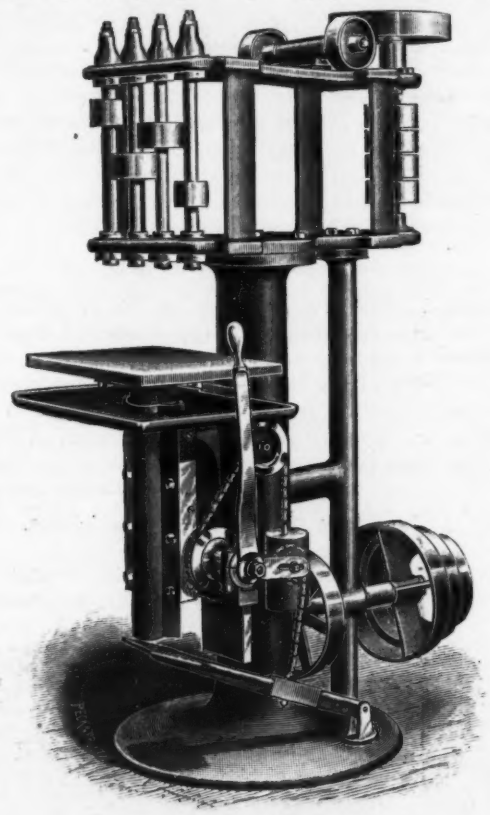
The double column supports a head of unusually rigid construction, and is designed to use extra long driving belts. The spindles are made of tool steel and run in hardened and ground steel bearings, having adjustment for wear. The end thrust of spindles is taken by tool steel steps at top. The driving power is ample, but spindles may be geared for extra heavy work.

The knee is gibbed to the column and is vertically adjusted by means of worm pinion and rack. The table is operated by an adjustable hand lever and foot treadle, and has an adjustable stop for determining the depth of hole to be drilled. It is counterbalanced by a weight that is always constant, regardless of the position of hand lever or treadle. The weight being suspended by chains, admits elevating the table with the hand lever, after the treadle reaches the floor. The machines are made in four sizes, having 2, 3, 4 or 6 spindles.

The Morgan-Gardner Electric Mining Apparatus.

In the accompanying illustration, Fig. 1, is shown a view of the mine locomotive designed by Mr. Morgan and known as the Morgan-Gardner electric mine locomotive, the name having been adopted from that of the company manufacturing the apparatus, the Morgan-Gardner Electric Company, of Chicago.

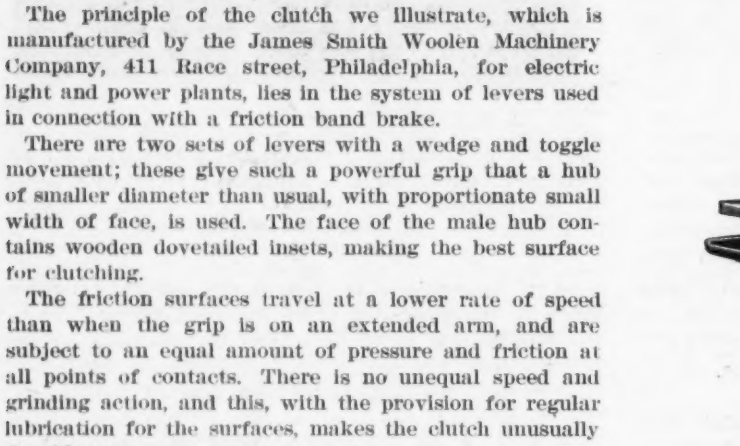
This locomotive has a hauling capacity of 50 h. p., and weighs seven tons. The hauling capacity may be better designated by stating that it will easily pull ten loaded cars at one time, each car weighing 3,500 pounds, and maintain its average speed up a 4½ per cent. grade.

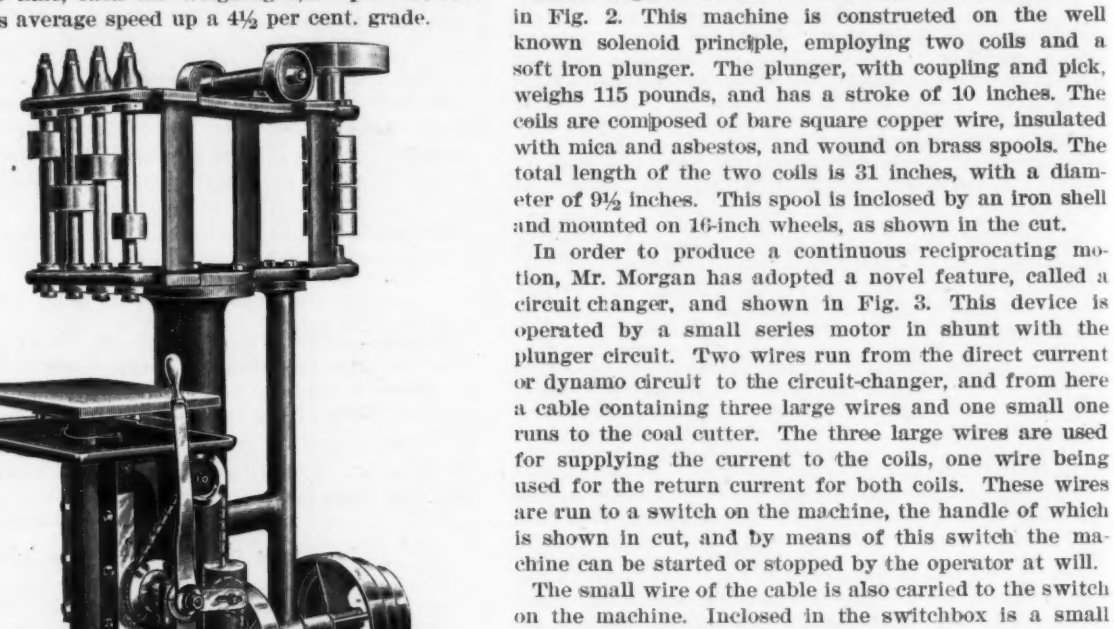


An Improved Gang Drill.

The locomotive has two motors of 25 h. p. each, one mounted on each axle. They are so wired that they can be operated in series or in multiple. The practice is to run them in series at the start, and then to change to multiple when under way.

The machine is controlled by a small series resistance and a series multiple controller. The motorman can sit at either end, according to the direction in which he is going, and can adjust the trolley as he chooses in practically the same way as a street car trolley is operated. The maximum current consumed is 130 amperes, at a pressure of 220 volts. The rails are used for the return circuit.





FIGS. 1 AND 3.—REGULATOR FOR COAL CUTTER AND MINING LOCOMOTIVE.

One of these locomotives has been in operation in the mine of the Old Pittsburgh Coal Company, at Hymara, Sullivan county, Ind., for about one year, and the record of its operation is the most striking illustration of its capacity.

During 21 days of the month of March, 1893, the locomotive hauled 6,971 cars, or an average of 332 per day, the greatest number in one day being 390. So well pleased was the coal company with this locomotive that another was installed, and has been successfully operating since July 8.

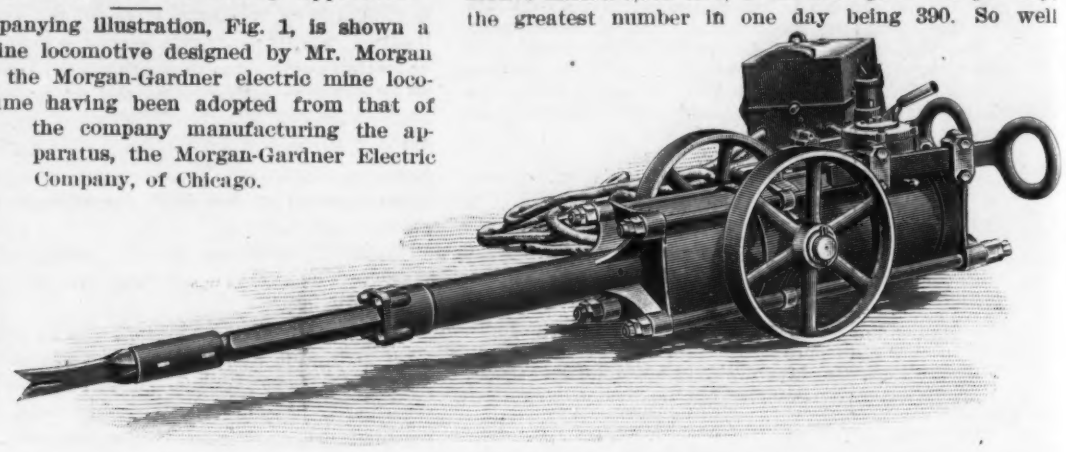


FIG. 2.—ELECTRIC COAL CUTTER.

The Morgan-Gardner electric coal cutter is shown in Fig. 2. This machine is constructed on the well known solenoid principle, employing two coils and a soft iron plunger. The plunger, with coupling and pick, weighs 115 pounds, and has a stroke of 10 inches. The coils are composed of bare square copper wire, insulated with mica and asbestos, and wound on brass spools. The total length of the two coils is 31 inches, with a diameter of 9½ inches. This spool is inclosed by an iron shell and mounted on 16-inch wheels, as shown in the cut.

In order to produce a continuous reciprocating motion, Mr. Morgan has adopted a novel feature, called a circuit changer, and shown in Fig. 3. This device is operated by a small series motor in shunt with the plunger circuit. Two wires run from the direct current or dynamo circuit to the circuit-changer, and from here a cable containing three large wires and one small one runs to the coal cutter. The three large wires are used for supplying the current to the coils, one wire being used for the return current for both coils. These wires are run to a switch on the machine, the handle of which is shown in cut, and by means of this switch the machine can be started or stopped by the operator at will.

The small wire of the cable is also carried to the switch on the machine. Inclosed in the switchbox is a small resistance, which is gradually thrown into the small motor circuit as the switch handle is moved around, thus controlling the speed of the small motor. As this motor operates the circuit changer, any variation in its speed causes a corresponding variation in the speed of the plunger. By this means the operator can vary the number of strokes per minute from 160 to 230. A wider range of speed could be obtained if desired, but the variation stated has been found to be sufficient.

At 190 strokes per minute, the pressure being 225 volts, the machine takes 26 amperes.

A remarkable thing about the circuit changer is that it will absolutely cut off the current without sparking. On several occasions it has cut off at the rate of 320 times per minute a current of 40 amperes and 250 volts.

One of these machines has been in operation in the mine of the Old Pittsburgh Coal Company since December, 1892, and has given the most satisfactory results. During 12 days of February and March this cutter ran 81¼ hours, or an average of 6.77 hours, and cut 570.5 feet, an average of 47.5, the maximum being respectively 9 hours and 65 feet. The average depth undercut was 4 feet 8 inches.

Financial Intelligence.

THE ELECTRICAL STOCK MARKET.

NEW YORK, Sept. 9, 1893.

GENERAL ELECTRIC'S fluctuations are sufficiently varied in character to keep even the best informed operators and investors in doubt as to the next move in the game that is being played in this quarter. Up one day to 49, the next day it goes off five points to 44; then a quotation of 49 is again scored; and so it goes on. That there are two parties at work on the stock there can be no doubt. Each side continues to put forth, as "official" utterances, statements that are directly contradictory, and, according to the preponderance of the weight of evidence on either side, so goes the quotation of General Electric stock. A week ago a receivership was again definitely promised; the very facts of the complaint under which this was to be brought about were put into circulation. Then the emphatic contradiction by the officials of the company lent a strength to the stock that was again dissipated, when, from inside sources, came definite statements regarding dividend payments. There is no question but that the vigorous bear campaign waged against the stock all summer has not been of long enough duration to satisfy the leaders of the movement, and they are not sparing any endeavor to lower quotations. There is no use denying the fact that the General Electric Company suffered as acutely as any single corporation from the tremendous strain that the contraction of credits consequent upon the financial panic imposed on all business concerns. The enormous shrinkage in the value of such securities of its subsidiary companies on which the General Electric Company has been accustomed to secure accommodation has subjected the parent company to terrible pressure. But the sure return of all business to its accustomed prosperity must help the General Electric Company in its endeavors to get the financial assistance that every corporation working under the modern system of credits must require. At a meeting of directors of the company held in Boston a statement was presented showing that the business of both the General Electric Company proper and of the subordinate companies was greatly benefiting from the general return of confidence. Cash sales were especially gratifying, and it was stated that "the failure of the company is more dependent upon the general financial situation enabling other parties to pay their bills than on anything else." Ex-Governor Ames, one of the largest holders of both preferred and common General Electric stock and professedly an enthusiast as to the company's prospects, admits that one dividend, "but no more," may be passed. The bears go him one or two better, and declare that the losses inflicted on the company have been such as to render the passing of at least two, if not more, dividends more than likely. It is stated that President Coffin and his immediate followers are to step down and out; that they are at loggerheads with the Edison people more than ever; Mr. Morgan is said to still resent the way Mr. Coffin once sold out on him; and, while not desirous of depreciating the stock's value, he won't have anything to do with rallying its quotations; charges and counter charges of mismanagement are made, and threats of protracted and ruinous litigation among insiders are put forth; these are the stories concerning General Electric with which Wall Street is regaled. Naturally people concerning whom these stories are floated hasten to give the lie to them, but despite the continued contradictions, they live and find lots of hearers, if not believers. Official information regarding the syndicate underwriting the plan to liquidate the $4,000,000 floating debt is to the effect that good progress is being made. There are less than twelve names upon the underwriting list, and they have all paid in the first 20 per cent. of their subscription to the $10,000,000 treasury securities, they are to get at less than half price, it is said.

THE WESTERN UNION TELEGRAPH COMPANY'S executive committee meet on Tuesday of next week to take action on the dividend, and to see what the statement of earnings for the quarter between June 30 and September 30 has to show. The dividend will, of course, be at the regular rate of 1¼ per cent. That talk last spring of increasing the dividend to a 6 per cent. per annum rate is nowadays never heard of. The chief interest attaches to the earnings. A liberal estimate has it that the net revenue for the quarter, after providing for interest on the bonds and for sinking fund requirements, will be $1,650,000. After deducting $1,250,000 from the $1,650,000 applicable to dividends, there will be a surplus for the September quarter of but $400,000, as compared with a surplus for a similar period in 1892 of $879,629 and in 1891 of $851,449. Besides the large falling off in business heavy inroads have been made upon the revenue of the company by the loss of business consequent upon the damage to property done by the terrific storms of this autumn. Some increased business was expected from the World's Fair; it is probable that this alone prevented the loss in earnings being larger. It is possible that the statement to be presented to the directors next Tuesday will not show $1,650,000 earned on the stock.

THE COMMERCIAL CABLE COMPANY has declared its regular quarterly dividend of 1¾ per cent.; it is payable Oct. 2. The stock of the company is $10,000,000 net, $2,284,000 is held in the treasury to retire the £200,000 6 per cent. debentures outstanding. The stock is now quoted at

WESTINGHOUSE ELECTRIC has been a little more active this week; the common is quoted around 21 and the preferred at 40. A small lot of scrip was offered this week on the Pittsburgh Stock Exchange at 88. Checks for the 3 per cent. interest due Sept. 1 have been issued to the holders of the scrip.

THE ANNUAL MEETING of the United Electric Securities Company is announced to take place at Portland, Me., on the 14th of this month.

ELECTRICAL STOCKS.

	Par.	Bid.	Asked.
Brush Ill., New York	50	20	40
Detroit Electrical Works	10	2	3
East River Electric Light	100	..	65
Electric Con. & Supply Co. pref.	15	15	16
" " " " " com	15	15	17½
Edison Electric Ill., New York	100	97	98
" " " 1sts	...	95	96
Edison Electric Ill., Brooklyn	100	95	100
" " " Boston	100	115	130
" " " Chicago	100	220	230
" " " Philadelphia	100	120	125
Edison Electric Light of Europe	..	2½	5
" Bonds	..	80	85
" Ore Milling	..	5	12
Fort Wayne Electric	..	5	5½
General Electric Company	100	45¾	46
" deb. 5's	..	80	81
Interior Conduit and Ins. Co	100	30	40
Mount Morris Electric	..	..	65
Westinghouse Consolidated	50	21	21½
" " pfd	50	38	39

AFFAIRS OF THE COMPANIES.

THE ELLSWORTH ELECTRIC ILLUMINATING COMPANY, of Ellsworth, Me., on Aug. 31 elected the following officers: S. H. Hamill, president; B. F. Miles, treasurer; H. E. Hamlin, clerk; P. A. Smith, general manager; C. M. Green, assistant treasurer.

MR. HENRY M. WHITNEY, at a meeting of the West End (Boston) Railroad directors on Sept. 6, resigned as president. The resignation was accepted, and a vote of thanks given the retiring president. Mr. Whitney says he wishes to devote more time to other neglected interests, principally the Dominion Coal Company.

A RECEIVER FOR THE JULIEN ELECTRIC COMPANY.—William H. Ricketts has been appointed Receiver of the Julien Electric Company, formerly of No. 120 Broadway, on the application of David E. Austen, as Receiver of Taxes, judgment having been entered in June, 1892, against the company, for $2,286 personal tax.

THE ANSONIA ELECTRIC COMPANY, CHICAGO.—Mr. F. S. Terry states that as soon as an inventory is completed and the trial balance finished, a definite statement will be made as to what extension of time will be necessary to enable the business to be carried on. The business has been profitable, increasing, perhaps, too rapidly, and it is hoped to resume at an early day.

THE EQUITABLE MANUFACTURING AND ELECTRIC COMPANY.—The sheriff has sold out the effects of the Equitable Manufacturing and Electric Company, at the factory, No. 611 West Thirty-sixth street, and at the office, No. 44 Broadway, under an execution of $29,675 in favor of Wendell Goodwin. One sale realized about $5,000, most of the articles being bought in for the account of Mr. Goodwin.

WALLACE & SONS, ANSONIA.—John B. Wallace, receiver, announces the resumption of work in that concern on Sept. 11, in every department but one, and with full force. The wire department will not require all the old hands back at present, but they will be taken back as needed. The appraisers are expected at once, and as everything is inventoried and tagged their work can be quickly accomplished. It is expected that work will be carried on continuously from the time of starting up.

NEW HAVEN, CONN.—The Morris Cove, the Whitney avenue and the State street surface railroads have been bought by a syndicate organized last winter with $1,000,000 capital, and the three roads will be equipped with electricity. The city division will be running before December, and will be double tracked. The line will be extended to Lake Saltonstall next spring, and it will then include 42 miles of rails. The new company has issued a mortgage to the American Loan Trust, of Boston, for $6,000,000. The new officers of the road are David Corey, of New Haven, president; Charles A. Warren, vice-president; secretary, treasurer and general manager, George A. Dodge, of New Haven.

THE NATIONAL ELECTRIC MANUFACTURING COMPANY.—The sale of the effects of this company has been postponed to Nov. 1 by an order of the court. The order provides that the sale shall be 30 per cent. cash, and the balance in one or two years at six per cent. The judge remarked that if, as stated in the documents filed, the property was worth $100,000, he would not feel justified in confirming a sale at less than $50,000. The postponement of the sale was asked for on the ground that financial stringency had created unusual conditions, that at this time cash payment by a purchaser of an adequate amount would be practically impossible, and that the actual value of the plant could not now be realized.

THE MATHER ELECTRIC COMPANY.—At a meeting of the creditors of the Mather Electric Company a proposition was made by the latter that all creditors accept 30 cents on the dollar, to be paid within 30 days. The liabilities of the company are about $195,000, including a mortgage of $45,000 and bank notes of about $90,000. The assets over the mortgage are a trifle over $50,000, which includes machinery, patterns, etc., especially adapted for the kind of work carried on at the factory, but if they were to be closed out it was the opinion they would not bring that amount. If this offer was not accepted, Mr. Chapman said the company would go into the hands of an assignee, and the estate would probably not be settled inside of a year, and he did not think the creditors would realize 15 cents on the dollar. If the creditors would accept this proposition the factory would resume operations as soon as there was a market for the product. A vote was taken on the acceptance or rejection of the proposition, and the majority were in favor of accepting it and signed. Others of the creditors did not sign.

NEW INCORPORATIONS.

KNOXVILLE ELECTRIC LIGHT AND POWER COMPANY, capital stock $20,000, has been formed for manufacturing and furnishing electric light. The promoters are Aaron L. Warfel, Charles E. Foote and William H. Moorehouse.

THE BROWN DYNAMO-ELECTRIC TELEPHONE COMPANY, Moline, Ill., capital stock $2,000,000, has been formed to manufacture and sell telephones, telegraphs and other electrical appliances and instruments. J. A. Brown, C. S. Brown and H. T. Moss are the promoters.

THE NATIONAL THERMOGRAPH AND ELECTRIC COMPANY, Chicago, Ill., capital stock $500,000, has been formed to manufacture and deal in water and steam-pressure recorders, grain staffs, electric batteries, etc. E. W. Applegate, John T. Todd and William J. Marks are the interested parties.

THE LITITZ ELECTRIC LIGHT, HEAT AND POWER COMPANY, Lititz, Pa., capital stock $4,200, has been formed for supplying light, heat and power by means of electricity to the public in Lititz borough, Lancaster county. The promoters are James E. Brobst, J. Frank Bush and H. S. Kauffman, Lititz, Pa.

THE RINGING ROCKS ELECTRIC RAILWAY COMPANY, of Pottstown, Pa., capital stock $100,000, has been formed for constructing and operating an electric railway in Pottstown, Pa. Cyrus Q. Guldin, Pottstown, Pa.; George C. Hollenbach, Sanatoga, Pa., and Ralph E. Shauer, Pottstown, Pa., are the promoters.

THE SUSQUEHANNA ELECTRIC LIGHT, HEAT AND POWER COMPANY, Spangler, Pa., capital stock $20,000, has been constructed for the furnishing of electricity for light, heat and power, etc. The promoters are: James A. McClain, Bellefonte, Pa.; J. J. Hauk, Carrolltown, Pa., and W. F. Taylor, Altoona, Pa.

THE LACONIA WATER POWER COMPANY, Laconia, N. H., capital stock $96,000, has been formed to buy and sell real estate and water privileges, buy and sell power by water, steam, electricity, etc. William C. Marshall, John C. Moulton, Frank P. Holt, Sam. Hodgson and J. W. Bushnell & Co., are the promoters.

Special Correspondence.

NEW YORK NOTES.

OFFICE OF THE ELECTRICAL WORLD,
167-176 TIMES BUILDING, NEW YORK, Sept. 11, 1893.

THE GENERAL ELECTRIC COMPANY has moved its Lynn lamp factory to Harrison, N. J.

POLICE SIGNALS.—The Police Commissioners of New York ask for an appropriation of $500,000 for a police signal system.

THE OLD TIME AND MILITARY TELEGRAPHERS, of New York, left for Chicago Sept. 9 to attend their annual convention, which takes place Sept. 12. Fully 400 members will be present.

GRAVESEND, N. Y.—As soon as the present season closes the construction of a trolley line from West Brighton to Manhattan Beach will be begun by the Coney Island & Gravesend Railroad Company.

MESSRS. BAKER & CO., Newark, N. J., the well known platinum refiners, have permanently secured the services of Mr. E. A. Colby, who will devote his time and attention to conducting a series of experiments, with a view of assisting the firm in producing the best possible product in their line.

MR. J. W. GODFREY, General Manager of New York Insulated Wire Company, is sanguine in regard to the business outlook generally. Mr. Godfrey states that the business condition in New York is entirely different from that of any other city, and that legitimate business has held out better here during the recent depression than elsewhere in the United States.

THE INTERIOR CONDUIT AND INSULATION COMPANY has brought suit against the firm of Carpenter & Tremaine, contractors, for using Vulca ducts in the wiring of the new city hall at Brockton, Mass. It is stated that bills of complaint are being drawn up by the attorneys of the company against other contractors and owners making use of the Vulca tube.

RAPID TRANSIT COMMISSIONER STEINWAY, of the Rapid Transit Commission, states that it has been intimated to the commission that a proposition will be made to it by a syndicate for the construction of an underground system of roads, and that they were unofficially informed that three-fourths of the capital necessary had been secured. As electricity will undoubtedly be the power employed it is sincerely hoped that the scheme will be successfully carried through.

A WORLD'S FAIR PRIZE WINNERS' EXPOSITION will be held at the Grand Central Palace, New York, in February and March, 1894, and will reproduce, as far as practicable, the most prominent and attractive exhibits at the World's Fair, including the principal prize winners. The officers and directors are: Richard G. Hollaman, president; Harry Munson, vice-president; E. J. Crane, secretary and treasurer; Daniel Browne, general manager. The advisory board consists of a number of prominent public and business men, among whom are Postmaster Dayton, Colonel Cockerill and Sheppard Knapp.

PITTSBURGH NOTES.

PITTSBURGH, Pa. Sept. 9, 1893.

THE HOMESTEAD ELECTRIC LIGHT COMPANY is making extensive improvements in its lighting plant. Several new dynamos and boilers are being added.

THE SECOND AVENUE PASSENGER RAILWAY reports an expense for the year of $71,681.64, and receipts of $111,804.70, while $10,000 were paid in dividends.

ANNUAL REPORTS have been made by a number of the local street railways to the state department at Harrisburg. The Pleasant Valley Passenger Railway Company says that it carried during the last year up to July 1, 7,942,480 passengers at an expense of $312,326.45. The receipts were $407,203.91, and dividends were paid to the amount of $84,000. The company operates 72 cars, and the length of its lines is 24 miles.

ROBERT D. NUTTALL, the well known inventor and machinist, and the head of the R. D. Nuttall Manufacturing Company, of Allegheny City, died at his home last Tuesday of typhoid-pneumonia. The illness which proved fatal was contracted in Toronto, Canada. Mr. Nuttall was thirty years of age. He was well known to the readers of this journal, in fact to everybody in the electric railway business, as it was he who invented the Nuttall trolley, so extensively used on electric street railways. He was also the inventor of a number of other electric appliances. He was the organizer of the Nuttall Machine Company, and remained of that firm until six weeks ago. The sadness of the young man's early demise is much increased by the fact that, while he is lying dead, his father, a brother and a sister are dangerously ill at their home in De Haven.

WESTERN NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
336 MONADNOCK BUILDING, CHICAGO, Ill., Sept. 9, 1893.

MR. WILLIAM H. McKINLOCK announces that he is located in rooms 319 and 320 Manhattan Building, where any communication will reach him, and where he will be glad to see his friends.

THE NEBRASKA ELECTRICAL MANUFACTURING COMPANY, Omaha, Neb., is a new firm, recently started for the manufacturing of electrical supplies and repairing. It will manufacture the Burke lightning arrester and other specialties. Mr. John T. Burke is manager of this company, which has located its shops at No. 1519 Harnay street.

THE WESTERN ELECTRICAL SUPPLY COMPANY, of Omaha, Neb., has recently taken into its business Mr. J. T. Burke, electrical engineer, who is now secretary of the company. Mr. G. W. Johnson, treasurer and manager, reports the supply business in good condition, although collections are a little slow at the present time. This firm keeps a full line of electrical supplies for construction in electric light and street railway work.

THE PHOENIX IRON WORKS COMPANY, Meadville, Pa., and 519 the Rookery, reports that the following concerns have recently installed Dick & Church engines: The Pittsburgh Construction Company, two 100-h. p. for lighting the Ferris Wheel plant at the World's Fair: The Northern Light Electric Company, Wapeton, N. Dak., 100-h. p., and the Marine City Electric

Light Company, Marine City, Mich., 100-h. p. engines. These are all non-condensing compounds.

THE SIOUX CITY (IA.) ELECTRICAL SUPPLY CO., has located its factory in the Hunt school building, which is well adapted for its business. It is doing considerable work in armature repairing for electric light and street railway plants, of which this company makes a specialty. It has now under way a new arc lamp, which is about ready for the market. This firm has the advantage of a brass foundry in its works, where are cast copper or brass segments and other material necessary in the construction of new and old dynamos and motors. This company is a contractor for electrical construction, and has installed a large number of plants in its territory.

CLEVELAND, O., Sept. 9, 1893.

THE UNDERGROUND TUBING of the Edison system for the Local Electric Light Company is now nearly all in place.

THE RUSSEL-SCOVIL CONSOLIDATED COMPANY has awakened considerable activity in the meetings of the City Council through its continued efforts to obtain a franchise. So far it has not been successful, but the energy with which its efforts are continued will, undoubtedly, some time result in success.

THE CLEVELAND ELECTRIC AND CLEVELAND CITY RAILROAD COMPANIES have introduced an ordinance to permit them to build a street car line on Wilson avenue. A cross-town line on Wilson avenue is much needed, and several concerns have before attempted to obtain a franchise to operate same. The ordinance submitted was to give the Cleveland Electric Railroad Company the privilege of using the tracks of the Cleveland City Railroad Company on Wilson avenue, and to extend their tracks from Broadway to the lake.

THE BOARD OF CONTROL has adopted a resolution fixing the rate of speed on the viaducts at eight miles per hour; on the draw-bridges, and 100 feet each side of them the rate of four miles per hour, and on the curves at the latter rate. The maximum speed is fixed at 12 miles per hour. At the West Side market the speed is limited to six miles. Motor men must ring their gongs at 50 feet distance from approaching cars, and conductors must call names of cross streets distinctly. They also passed a resolution to the effect that the arrangements of transfers of the East Cleveland & Scovill and Wilson Avenue lines was not satisfactory. It is apparent that the Cleveland Board of Control intends to make its existence felt by the electric roads.

OREGON CITY, Ore., Sept 4. 1893.

THE EAST SIDE RAILWAY COMPANY, of Portland, Ore., has moved its headquarters to 212 Madison street, where the officials occupy neat and well appointed offices.

THE WILLAMETTE FALLS RAILWAY, at Oregon City, is completed, and work has been suspended for the present. The track will not be ballasted until the cars arrive. Civil Engineer C. A. Miller was in charge of the work. Contractor Scribner, of Spokane, superintended the overhead construction. Fifty-foot poles are used on a part of the line, so as to accommodate the Portland General Electric Company's circuits.

THE PORTLAND GENERAL ELECTRIC COMPANY is employing a large force of men, both night and day, upon the coffer dam at the foundations of the new electric station in Oregon City. The work going forward there is of a very massive character, as evidenced by the enormous concrete walls which are being constructed, doubling the width of the canal which conveys water to the water power plants on the West Side. A marble switchboard is being installed in the company's East Side station.

ENGLISH NOTES.

(From Our Special Correspondent.)

LONDON, Aug. 30, 1893.

THE CITY LIGHTING.—The announcement that the City Commissioners of Sewers contemplate removing the gas lamps from the streets of the city of London at an early date has given rise to most dismal forebodings in gas journals. One of them, the "Gas World," thinks that to even talk about removing gas lamps, while experience shows that failures of the arc lights are not altogether out of the question, is folly, and to actually remove them would be "almost sheer madness."

THE TELEPHONE QUESTION.—The unpopularity which the National Telephone Company, by its indifferent service, high charges, and somewhat overbearing tone, has been acquiring for the past five or six years, is showing itself now in the determined efforts which municipal autnorities all over the country are making to prevent the Post Office from arranging terms with it which shall be unduly disadvantageous to the country. In the House of Commons the Postmaster-General is being frequently and severely cross-examined as to the terms of the agreement between the Post Office and the telephone company, which is now in course of preparation, and endeavors have been made to induce him to lay the draught of the agreement before the house. Up to the present the Postmaster-General, acting on a resolution passed by the house last session, has refused to accede to this request. He has, on the other hand, stated that when the telephone trunk wires come under the control of the Post Office their use will be subject to the usual regulations forbidding any favor or priority being given to particular persons. This announcement ought to reassure those municipalities who are contemplating establishing municipal telephone services, since subscribers to their exchanges will not be put to a disadvantage in regard to subscribers of the National Telephone Company's exchanges in the matter of inter-urban connections.—The Postmaster-General has replied to the demand of the Glasgow corporation for a telephone license to the effect that, in view of the intimate relation between the question of further telephone licenses, and of statutory powers for laying telephone wires underground, he cannot, at present, arrive at any decision with regard to the application in question. The Glasgow Town Council, however, is by no means satisfied with this answer, and has sent a deputation up to London to interview the Postmaster-General, and to bring pressure to bear upon members of Parliament to induce the Postmaster-General to give a more decided answer. It will thus be seen that we do not propose to allow ourselves to be dominated by any monopolists other than the Postmaster-General.

GERMAN NOTES.

BERLIN, Aug. 30, 1893.

THE FIRST NUMBER of a new electrical monthly, published in Leipzig, entitled "Elektrotechnische Bibliographie," has just appeared. Its object is to provide a ready reference index to current electro-technical literature. It is modeled after the well known "Fortschritte der Elektrotechnik," and may be compared to "The Technical Index of New York," with which, in fact, as regards the arrangement of the matter, it is almost identical, although its scope, for the present at least, is much more limited.

THE ELECTRIC LIGHTING of the Lustgarten, in Berlin, to which reference has been made in the columns of The Electrical World, is now an accomplished fact. Ten arc lamps symmetrically arranged in the grounds have been installed, current being taken from the city mains. The lamps are mounted on high ornamental candelabra of exactly similar pattern to those in Unter den Linden, and burn with the same brilliancy and steadiness which characterize the arc lighting of that famous thoroughfare. The effect as viewed from the vantage point of the Royal Castle, immediately opposite the Lustgarten, the classic columns of the Old Museum thrown into high contrast with the surrounding foliage, is extremely pleasing.

THE BARMEN INCLINE RAILWAY, the first electric rack railway in Germany, built by Messrs. Siemens & Halske, was opened on the 1st ult. The line starts in about the middle of the town, and has a total length of just over a mile. The difference in level between the upper and lower ends is 186 yards; the average grade, therefore, being 10 per cent., and the maximum grade 20 per cent. Between the two termini there are two statons. It is a double-track line throughout; one metre gauge. In the town grooved rails are used; on the rest of the road Vignoles rails. In order to prevent the rails or the rack working loose, a special form of chair bolted to the under side of the sleeper has been adopted; and at distances of 30 to 40 yards every couple of sleepers are anchored to deeply set solid masonry. The cars can be changed over to either track at both the end stations by means of traveling platforms which lock the rails automatically, and require therefore no special attendance. The passenger cars carry 34 to 36 people, 28 seated and six or eight standing; they are 26½ feet long, and eight feet wide. Each car is divided into four compartments, of which the two middle ones are reached from the side, and the outer ones from the platforms. Each car has two cog-wheels which work in the rack laid between the rails, and two independent electromotors each of 36 h. p. Each cog-wheel is provided with a brake arrangement capable of being worked from either platform by means of a worm shaft. The motors also serve as additional brake power in case of necessity by reversing the current and consequently reversing the motion of the car. Current at 500 volts is furnished to the motors by an overhead wire and trolley. The power station, which is located at the lower terminus, contains three Steinmuller water-tube boilers—one of which is in reserve—working at 150 lbs. pressure, and two compound condensing engines developing 250 h. p. at 165 revs. per minute, coupled directly to two Siemens dynamos generating current at 500 volts.

News of the Week.

ELECTRIC LIGHT AND POWER.

RIVERSIDE, N. J., is to have the electric light.

CLEBURNE, TEX., is soon to have electric lights.

FORREST, ILL.—The city voted Aug. 29 to issue bonds to purchase an electric light plant.

BELLE PLAINE, IA.—The town has voted to put in electric lights. The Council will complete the contract for the plant.

ALLEGAN, MICH.—Guard & Fairfield are preparing to build a two-story flouring mill which will be operated by electric power.

LONDON, O.—The stockholders of the London Gas Light Company amended its charter so as to include the authority to erect an electric light plant in this city.

HUMBOLDT, TENN.—At a mass meeting of the citizens it was decided that Humboldt should have a system of waterworks and an electric light plant.

FINDLAY, O.—The Finance Committee has been instructed to purchase a dynamo and engine for the purpose of supplying 25 incandescent lights for the pump station.

MOUND CITY, IA.—Sealed proposals will be received to Oct. 1 for furnishing the city of Mound City with water and electric lights, as per specifications on file at the office of M. F. Browner, City Clerk.

PONTIAC, ILL.—Sealed proposals will be received to Oct. 15 for furnishing electric lights to the city for a period of five years from June 1, 1894, as per details to be had of W. J. Butler, City Clerk.

BATAVIA, N. Y., will soon issue bonds to pay for the proposed electric lighting plant. It is stated that Lawyer Kinsey, of Buffalo, who owns the present electric lighting plant, is willing to sell cheaply.

MARIETTA, O.—A committee of City Council has been appointed to consider the question of putting in additional machinery in the electric lighting plant owned by the city to supply additional commercial lighting.

PHILADELPHIA, PA.—Wendell Smith, representing the Drexel-Childs-Walsh syndicate, has applied for charters under which to operate their steam heating and electric lighting plant at Overbrook, where they propose to erect a large power house.

ELLICOTT CITY, MD.—The Ellicott City Light and Power Company will make material improvements to their plant, and a committee has been appointed to report on same to next meeting of directors. Senator John G. Rogers is president, Louis N. Gets is secretary and Gerhardt Butke is treasurer.

OAKLAND, CAL.—The Council has decided to put in, in addition to the 279 electric lights already in use, 120 electric lights of 2,000 c. p. This will make a total of 399 electric lights and 100 gas lights. For that purpose $64,000 has been set aside. Last year the cost for city lighting was $59,508, but 321 gas lights were used.

MOLINE, ILL.—The City Council has closed a contract by which it sells to the People's Light and Fuel Company, for $7,900, its present electric lighting plant. The company does not expect to be able to make any great use of the present plant, but will proceed at once to put in new dynamos to begin with 120 lights, the minimum number provided for in its five-year contract. The present number is 98.

BINGHAMTON, N. Y.—Sealed proposals will be received by the Trustees of the Binghamton State Hospital, at the office of the secretary, H. G. G. Rogers, until Sept. 20 for the following work, namely: 1. For wiring the hospital buildings for thirteen hundred (1,300) incandescent electric lamps, of sixteen (16) c. p. each. 2. For wiring and erecting ten (10) arc lights on the hospital premises. 3. For the installation of engines and dynamos for running an electric light plant. 4. For a building for the electric light plant and boilers at the river, adjacent to the steam and water plant now in operation. 5. For a building for engines and dynamos, adjacent to the boiler house on the hill. 6. For the erection of two (2) high pressure steam boilers. 7. For the installation on the hospital premises of a complete electric lighting plant, with the power station located at the river, adjacent to the present steam and water plant. 8. For the installation of a complete electric lighting plant, with the power station adjacent to reserve boiler house on the hill. 9. For the delivery on the hospital premises of a current of electricity of sufficient quality and power to run 1,300 incandescent electric lamps, also a current for 1,500 incandescent electric lamps, and 10 arc lamps, as may be required. All of which will be according to plans and specifications furnished by I. G. Perry, architect, and each bid shall be separate and distinct from the others.

THE ELECTRIC RAILWAY.

NEW BRITAIN, CONN.—It is proposed to extend the electric line to Berlin.

GREENSBURG, PA.—An electric road to Freeport, 28 miles long, is projected.

THE FAIRHAVEN (CONN.) & WESTVILLE RAILROAD is to change to electric power, and be considerably extended.

MUNCIE, IND.—The Muncie City Council has granted a 35-year franchise to the Citizens' Street Railway Company.

LEAVENWORTH, KAN.—The Leavenworth Electric Street Railway Company will reorganize and put matters in shape for a resumption of work.

PHILADELPHIA, PA.—Invitations to bidders will soon be issued in the matter of the proposed mammoth power house for the People's Traction Company.

BRIDGETON, N. J.—The Bridgeton & Millville Electric Railway Company contemplate extending their line to Salem, Deerfield, Daretown and Woodstown, N. J.

BRIDGETON, N. J.—The Electrical Subway Commission has granted right of way through the streets to the South Jersey Traction Company, and work has already been commenced.

SYRACUSE, N. Y.—The Syracuse, Fayetteville & Manlius Electric Railway Company is seeking a franchise for the construction of railway tracks in East Water, Madison and other streets.

COLUMBIA, PA.—The directors of the Columbia & Donegal Electric Railway have decided to extend the line to Marietta, a distance of three miles. William B. Given is president of the road.

LOCKPORT, N. Y.—The Lockport Common Council has granted the Lock City Electric Railway an extension of time to complete its road to Nov. 1. It is doubtful if the road can be finished by that time.

LANCASTER, PA.—An item in the Lancaster "New Era" states that Col. S. C. Slaymaker, civil engineer, and his assistants, have begun work on surveys for the line of the Lancaster & Lititz and Manheim & Conestoga Valley Railways.

LYNN, MASS.—The Board of Selectmen of Melrose has granted the Lynn & Boston Railroad permission to lay tracks and equip with electricity a spur from its present tracks to the Wakefield line, work to be commenced within 30 days.

FRAMINGHAM, MASS.—Selectmen have granted the request of the Natick Electric Street Railway Company, and extended its franchise to build a road to the Ashland town line to July 1, 1894. The franchise would have expired next October.

BOSTON, MASS.—The West End Street Railway Company has accepted the locations offered on Huron and Brattle streets by the aldermen of Cambridge, and the roadmaster has been ordered to begin work at once.

POTTSTOWN, PA.—The Ringing Rocks Electric Light and Power Company has been organized with a capital of $10,000 to build a three-mile electric line to Ringing Rocks Park. Cyrus Q. Guldin is president, R. E. Shaner is secretary, and A. K. Shaner treasurer.

WEST CHESTER, PA.—It is stated that the Wilmington & Northern Railroad is behind the scheme for an electric line to Unionville, which, if built, will become an extension of the line between West Chester and Lenape, where it connects with the Wilmington & Northern Railroad.

SYRACUSE, N. Y.—The Syracuse Street Railway Company is trying to get right of way for three large extensions, one to the village of Solway, one through the 13th Ward, and the third to furnish better communication with the University by running cars direct to the grounds of that institution.

PITTSBURGH, PA.—It is stated on good authority that John Burns, of the firm of Burns & Son, liverymen; John C. Reilly, of the West End Street Railway Company; Thomas S. Bigelow, and other well known Pittsburghers, are interested in a project to build a switchback railway at Schenley Park.

LAWRENCE, MASS.—The South Side Street Railway Company has been formed to connect Lawrence and Lowell by a street railway. The capital stock of the company is $90,000, and the incorporators are W. S. Know, of Lawrence, and A. C. Russell, J. L. Chalifoux and Larkin T. Trull, of Lowell, Mass.

BALTIMORE, MD.—The directors of the City Passenger Railway Company have authorized President Bowie to receive bids for building the electric power house and car shops for the company at Light and Marshall streets, as per plans of Engineer Connett, of the company, to be 168 × 200 ft. and to have power sufficient to generate electricity to operate all the lines of the company. In addition, the building will contain a department for repairing cars and a car shed for storage.

LOCKHAVEN, PA.—In the matter of the proposed electric railway, ex-Senator Peale has been interviewed, and he states that in his opinion it is doubtful if such road would pay. Some time ago, he and others interested, hired a competent engineer to go over the ground and report, which was done, but when the petition for franchise was laid before the Council it was so loaded with amendments that the petitioners refused to accept it, and their offer was withdrawn. It is still believed that Mr. Peale will push the matter when finances become easier.

WASHINGTON, D. C.—A bill has been introduced into the Senate to incorporate the Washington Traction Company. The incorporators are: R. N. Batchelder, E. W. Rollins, J. R. Baldwin, H. M. Earle and A. G. Wheeler, and the capital stock will be $1,000,000. They will use the underground traction system in use on the Rock Creek Railroad system on U street, and outside the city limits; the trolley system will be used until the districts become settled, when it must be abandoned at request of the Commissioners. Double and single tracks are provided for in the bill.

PERSONAL NOTES.

PROF. ANDREW JAMIESON returned to Europe on Sept. 5.

PROF. E. HOSPITALIER sailed for France Sept. 9 in the Champagne.

PROF. W. E. AYRTON and daughter sailed for Europe on Tuesday, Sept. 5.

MR. J. W. LATTIG has been appointed superintendent of the telegraph lines and electrical apparatus of the Lehigh Valley Railroad Company over its entire system, with headquarters at South Bethlehem.

PROF. E. E. N. MASCART sailed for Europe on Sept. 5. Prof. Mascart, who has been lecturing on optics for the last six years, will again take up electricity this fall, paying particular attention to alternating current and motors.

MISCELLANEOUS NOTES.

STREET SPRINKLING BY ELECTRICITY.—Several cities have sprinkling cars on electric lines, the latest reported being Lowell, Mass.

ELECTRIC MOTORS FOR SPECIAL WORK.—A 30-h. p. electric motor was recently used in Indianapolis in turning up the bearings of the shaft of a large engine. The motor was belted to the fly-wheel of the shaft which was turned in place.

ELECTRICITY ON THE CANALS.—By a rider introduced, apparently surreptitiously, in the bill authorizing experiments with electricity for propelling canal boats, the money appropriated for administrative purposes is placed at the disposition of experimenters.

THE GENERAL ELECTRIC COMPANY'S Schenectady plant, which has for several months past been running with a reduced force on short time, re-engaged several hundred of its former employees on Sept. 7, and it is expected that the works will soon be running on full time.

TELEGRAPH LINES.—The daily press is discussing the subject of underground telegraph lines and better construction of pole lines. They refer to the prostration of the service of the Western Union company by the two recent storms, and to the little damage done to the better constructed lines of the Long Distance Telephone Company.

THE CHICAGO & CENTRAL INDIANA ELECTRIC RAILROAD COMPANY has failed, and the promoters hurriedly left the field of their operations. The moving spirit in this scheme to build and equip 400 miles of electric road was one E. J. Pennington, who will be remembered as the man who attempted to obtain capital for an air ship several years ago.

THE BALTIMORE POLYTECHNIC INSTITUTE has added electrical engineering to its curriculum. Mr. W. H. Hall, who has charge of this department, has completed the outline of 40 lectures to be delivered during the coming session upon electric currents, conductors, measuring instruments, alternating and direct-current dynamos, calculations for designing, arc and incandescent lighting, motors, transformers and the telegraph and telephone. The lectures will occupy one or two hours each, and will be accompanied by experiments, mainly performed by the students.

THE TELEPHONE IN NORTH CAROLINA.—The North Carolina Board of Railroad Commissioners, acting under authority conferred upon them by the last legislature, recently decided that certain telephone charges were excessive and intimated that a schedule of telephone rates for cities and towns, according to the number of phones used, would be provided. The town of Statesville now wants a telephone exchange, and more than the necessary number of subscribers have been secured; but it will be some time before telephonic connection between them will be made, if at all. Mr. McCleur, the Southern superintendent, has notified the Statesville people that the executive officers have instructed him "not to undertake any new enterprises within the State of North Carolina for the present—until the attitude of the Board of Railroad Commissioners with reference to the telephone interests is fully developed."

A POPULAR ELECTRIC RAILWAY.—An electric street railway is being built under unusual circumstances at Hanover, a town of 4,000 inhabitants, situated about 20 miles from York, Pa. An agricultural fair is to be held there during the third week of September. The residents of the town and adjacent territory are anxious to have the road in operation during the fair. The work not progressing fast enough for their satisfaction, the people have volunteered to help build the line gratuitously, and merchants, mechanics and professional men have taken up the pick and are working in turn on the street. An unusual spectacle was presented recently when a procession of about 100 men from a neighboring village entered the town, headed by a brass band. The men carried shovels and picks on their shoulders, and at the command of their leader set to work and made the dirt fly for several hours, during which time the band discoursed lively airs. When nightfall arrived the men formed into a solid phalanx, gave three cheers for the electric road, shouldered their tools, and marched to their homes.

Trade and Industrial Notes.

C. C. PECK, Ellwanger & Barry Building, Rochester, N. Y., sends us a copy of a neat pamphlet describing and illustrating the Peck double-deck boiler, as well as other information of a general character relating to boilers.

THE ELECTRIC APPLIANCE COMPANY, 242 Madison street, Chicago, makes a specialty of VomCleff & Co.'s all steel pliers, connectors and other electric tools, and has on exhibition in its World's Fair space a very handsome sample board of its goods, including Cleff and Brown long-nose pliers, diagonal end cutting nippers, linemen's wrenches, etc.

THE HEINE SAFETY BOILER COMPANY, 421 Olive street, St. Louis, Mo., sends us a copy of its new catalogue entitled Helios, a handsome volume of 161 pages, bound in cloth. A considerable part of the matter in the book consists of data and information of various kinds of especial interest to engineers and steam users, and as a work of reference will be of value on the office desk.

A. B. LAWRENCE, 225 Pearl street, New York City, has received a voluntary testimonial from the manager of the Perry Electric Light Company, Perry, N. Y., in which it is stated that: "The pulley covering fits perfectly and works like a charm. A belt which we were formerly obl'ged to run so tight that the bearings were always hot, we can now run so loose that it almost drags on the floor."

THE EDWARD P. ALLIS COMPANY, Milwaukee, Wis., has issued a handsome catalogue devoted to the celebrated engines and other lines of machinery made by them. The book, which is 9 inches by 15 inches in size, is well printed on an excellent quality of paper and artistically bound. Of the forty odd sheets printed on only one side, only four are devoted to text, the others containing artistic engravings of machinery, workshops, etc.

THE BALL ENGINE COMPANY, of Erie, Pa., has secured, through its New York office, after a strong fight, an order for a 100-h. p. Ball engine from the Brooklyn Navy Yard. This company has also recently sold through its various agents two 100-h. p. Ball engines to S. E. Olsen & Co., Minneapolis, Minn.; one 35-h. p. engine to the Turf Villa Summer Garden, Philadelphia, Pa., and a 125-h. p. engine to the Wilkes-Barre (Pa.) Electric Light Company.

HINE & ROBERTSON, 57 Cortlandt street, New York, pack the Straight Line indicator valve reducing wheel and planimeter, all in one velvet lined, polished cedar case with nickel lock and trimmings. They also pack the indicator and valve in a smaller case of the same handsome appearance, but they inform us that most engineers prefer the entire outfit in one case, giving them means to indicate any engine and figure out the horse power while on the spot.

THE DAHL ELECTRIC COMPANY, 136 Liberty street, N. Y., has just completed and shipped several of the Storey buffing motors. One of the 2-h. p. buffers went to the Bingham Hotel, Philadelphia, while the Plaza Hotel, New York, has also started up a buffer of the same power, and the New Netherlands Hotel will place a 3-h. p. buffer in operation immediately. The 3-h. p. buffer at the Waldorf Hotel, as well as a similar one at the New Amsterdam Hotel, are both doing excellent work, keeping their silverwar up to a standard which, it is claimed, it is impossible to attain by hand work.

THE BOULTON CARBON MANUFACTURING COMPANY, of North Tonawanda, N. Y., of which the veteran carbon manufacturer Mr. W. H. Boulton is president and general manager, Mr. Geo. P. Smith, secretary, and Mr. J. H. Schmeck, treasurer, is making a specialty of carbon brushes for motors, in addition to supplying carbon rods for electric lights. Mr. Boulton's long experience in this field ought to be a sufficient guarantee of the quality of anything in the carbon line bearing his name. Mr. Boulton's friends will be glad to know that the Boulton Carbon Manufacturing Company is doing a nice business and that its outlook is promising. The company will be glad to receive correspondence from those desiring carbons or carbon brushes.

STERN & SILVERMAN, of Philadelphia, Pa., well known contractors, have recently secured a contract for a large amount of construction work, including the construction of the entire line of the Gray's Ferry, Morris & Tasker and Long Lane divisions of the Philadelphia Traction Company's route; the complete equipment of the power station for the Mahanoy Tranction Company of Mahanoy City, Pa., consisting of 150-h. p. boilers, two 350-h. p. vertical engines, and two 350-h. p. direct coupled engines; the equipment of the entire road of the Tenth and Eleventh street lines of the Electric Traction Company, of Philadelphia; the construction and equipment of the electric line of the Union Stockyards at Claremont, Baltimore, and the construction of the West Jersey Traction Company's line from Camden to Pavonia, N. J.

THE ACME FILTER COMPANY, 700 N. Main street, St. Louis, Mo., reports August as its best month, the following being some of its sales: Lambertville Electric Light and Power Company, New Jersey; Morganton Electric Light and Power Company, North Carolina; Central Electric Company, Lexington, Ky.; Coudersport, Allegheny & Pine Creek Railway Company, Pa.; Columbia Water and Light Company, Mo.; Cincinnati Inclined Plane Railway Company, Ohio; Urbana Electric Light and Power Company, Ohio; Briggs, Young & Company, Dallas, Tex.; Parsons Light and Heat Company, Kansas; Arthur S. Partridge, St. Louis, Mo.; Vacuum Oil Company, Rochester, N. Y.; Vacuum Oil Company, New York City; Vacuum Oil Company, St. Louis, Mo.; Standard Oil Company, Cincinnati, O., Leonard & Ellis, Portland, Ore., Cincinnati, O., and San Francisco, Cal.; English Supply and Engine Company, Kansas City, Mo., and many others.

Business Notices.

BATTERY CUT-OUT, CHEAP.—Sensitive, reliable, never requires attention. Gas lighting much improved by its use. Electric Supply Company, of 105 South Warren street, Syracuse, N. Y.

DESK ROOM in the commodious office of THE ELECTRICAL WORLD, in the new Monadnock Block, Chicago, may be obtained by applying in person or by letter to the office, 936 Monadnock Block.

OUR ILLUSTRATED RECORD OF ELECTRICAL PATENTS.

UNITED STATES PATENTS ISSUED AUG. 22, 1893.

(IN CHARGE OF W. A. ROSENBAUM, 177 TIMES BLDG., N.Y).

503,568. STARTING DEVICE FOR ELECTRIC MOTORS; Alton D. Adams, St. Paul, Minn. Application filed Oct. 19, 1891. In a device of the class described, the combination of the series of contacts with intermediate resistances, the pivoted contact arm, and the stop engaging said arm as it breaks the circuit at the contact in circuit with no included resistance, so as to prevent reverse movement of the arm, and compel it to be turned forward through a complete rotation in the same direction to reach said contact again.

503,570. ELECTRIC RAILWAY TROLLEY SWITCH; John H. Allison, Elkhart, Ind., Assignor of one-half to John G. Rich, Auburn, N. Y., and Daniel G. Reed, Richmond, Ind. Application filed March 3, 1893. In a trolley switch-mechanism, the combination with the single-line wire and the double-line wires making a junction therewith, and with a switch-guide located alongside of said line wires at the junction thereof, of the trolley-arm adapted to run on the line wires, and a switch-arm movably supported on the trolley-arm and shiftable from and into position for engaging the switch-guide to carry the trolley-arm from the single-line wires to one of the double-line wires.

503,574. DYNAMO-ELECTRIC MACHINE OR MOTOR; Charles S. Bradley, Avon, N. Y. Aplication filed April 15, 1893. A dynamo-electric machine or electric motor provided with a number of independent armature windings carried by the same shaft, commutators connected with the several windings, connections between the several windings coupling them in series and an electrical connection between the base of the machine and a point of the circuit between the terminal brushes.

503,581. SELF-EXCITING ALTERNATE-CURRENT ELECTRIC GENERATOR; Philip Diehl, Elizabeth, N. J., Assignor to the Westinghouse Electric and Manufacturing Company, Pittsburgh, Pa. Application filed April 11, 1887. The combination with the field-magnet of an electric generator delivering alternating electric currents and its magnetizing coils, of a single armature core revolved within the field of force created by such field-magnets, two coils wound thereon adapted to revolve simultaneously in the same field and means for rendering continuous a portion of the currents generated and transmitting the same through said magnetizing coils.

503,589. ELECTRIC MEASURING APPARATUS FOR ALTERNATE CURRENTS; Sydney Evershed, London, England. Application filed Dec. 22, 1891. In any electromagnetic apparatus for the measurement of electric pressure, power or work, in an alternating current, the combination with the working coil of the said apparatus of a shunt impedance coil, about the said working coil, to produce the effect on the measuring instrument compensating for the errors due to an alternating current.

503,590. TELEGRAPHY; Stephen Dudley Field, Yonkers, N. Y. Application filed Jan. 16, 1893. A transmitting generator for a signaling system containing a chokeless coil supported in a magnetic field, a harmonic vibrator for vibrating the coil across the lines of force of said field, said vibrator being normally strained, and a key and controlling magnet for instantly releasing the strain, whereby vibrations are instantly sent to line upon operation of the key.

503,595. ELECTRIC METER; Fred L. Gregory, Niagara Falls, N. Y. Application filed May 4, 1892. In an electric meter, the combination with the magnet energized by the current to be measured, and with the timepiece having a meter mechanism actuating pinion, of a rock-shaft having a hand-wheel and hand connected together and loosely mounted thereon, an arm connected with said rock-shaft, gearing carried by said arm in mesh with the hand-wheel and adapted for engagement with and disengagement from the pinion of the timepiece, as described, an armature operable by the magnet and connected to swing said arm, and means for preventing the retraction of the hand-wheel, all combined and co-operating.

503,602. ELECTRIC SEARCH-LIGHT; Rudolph M. Hunter, Philadelphia, Pa., Assignor to the Thomson-Houston Electric Company, Connecticut. Application filed June 19, 1893. In an electric search light, the combination of an electric lamp adapted to maintain an arc, means to concentrate and direct the rays of light from the arc, and electro-magnetic devices thrown into action successively to cause the means for concentrating and directing the rays of light to vibrate. (See illustration.)

503,604. ELECTRIC CABLE; Milo G. Kellogg, Chicago, Ill. Application filed Nov. 15, 1890. The combination of the individually insulated wires laid up in cable form with their insulators in contact as usual and other wires occupying the angles or spaces between the insulations of the individually insulated wires.

503,621. SYSTEM OF ELECTRICAL DISTRIBUTION; Oliver B. Shallenberger, Rochester, Pa. Application filed March 3, 1887. In a system of electrical distribution, the combination with a circuit supplied with alternating electric currents of a group of converters having a ratio of conversion of one to one and having their primary coils connected in multiple arc and their secondary coils connected in series.

503,622. SYSTEM OF ELECTRICAL CONVERSION AND DISTRIBUTION; William Stanley, Jr., of Great Barrington, Mass., Assignor by mesne assignments to the Westinghouse Electric and Manufacturing Company, of Pittsburgh, Pa. Application filed March 28, 1887. In a system of electrical conversion and distribution, an auto-converter, a feeding circuit including more or less of the coils of said auto-converter, and two or more derived circuits, having their terminals connected across more or less of the coils of said auto-converter. (See illustration.)

503,650. INCANDESCENT ELECTRIC LAMP; Edward Egbert Cary, Boston, and William Emery Nickerson, Cambridge, Mass. Application filed April 3, 1893. In an incandescent electric lamp, the combination of the glass bulb, having a shoulder between the air-tight sealing plug and the vacuum chamber; with the loosely fitting disc, filament, leading-in wires and plug of fusible cement.

503,669. INCANDESCENT ELECTRIC LAMP; William Emery Nickerson, Cambridge, Mass. Application filed April 7, 1893. In an incandescent electric lamp, the combination of the glass globe, filament and cement plug, with a supplemental disc having a chamber between it and the cement plug and a reflecting cone.

503,670. INCANDESCENT ELECTRIC LAMP; William Emery Nickerson, Cambridge, Mass. Application filed July 19, 1893. In an incandescent electric lamp in which the neck of the lamp bulb is closed air-tight by a plug of fusible cement, bends in the leading-in wires located within the cement plug but not at its inner surface and adapted to prevent the said wires from breaking their perfect mechanical contact with the said cement.

503,671. INCANDESCENT ELECTRIC LAMP; William Emery Nickerson, Cambridge, Mass. Application filed July 17, 1893. In an incandescent electric lamp, a fusible cement plug for closing the neck of the lamp globe air-tight, said plug consisting of two layers, one comparatively hard and infusible, located nearer the filament, and one comparatively soft and fusible, located upon and outside the hard layer.

503,688. ELECTRIC-LIGHTING SYSTEM; Lucien Vialet-Chabrand, of Ciotat, France. Application filed April 2, 1892. The combination in an electric lighting system of an electric lamp, or lamps, lighting and extinguishing switches, an electromagnet, its core carrying a lighting coil, and also an extinguishing coil wound in opposite directions, its armature connected with the main circuit, contact point or screw in the lighting circuit, contact point or plate connected with said armature, the contact being closed by the lighting circuit attracting the armature and released by the extinguishing circuit repelling said armature.

503,690. APPARATUS FOR CONTROLLING ELECTRIC MOTORS; Schuyler S. Wheeler, New York, N. Y., Assignor to the Crocker-Wheeler Electric Company, of same place. Application filed June 6, 1892. A switch having an operating handle connected to a source of power which carries the movable electrode always in the same direction in combination with retarding mechanism and a mechanically actuated stop device which is set and released by the movement of the operating handle in opposite directions.

503,693. SWITCH FOR ELECTRIC LIGHTS; Ernest Blasser, of Boston, Mass. Application filed Aug. 3, 1892. In an electric switch the combination with an electric lamp, and suitable conductors, of a key and spindle, the spindle provided with an insulated plate having thereon two conducting posts, and adapted by means of the key to be brought into, or removed from, contact with the two conducting posts, electrically connected respectively with said conductors so that the electric circuit can be made and broken, the spindle, plates and posts being contained within a solid shell connected with a tube in which the conductors are placed.

503,709. ELECTRIC SIGNAL DEVICE; Carl Schwennicke, Berlin, Germany. Application filed March 30, 1893. An electric signaling device, comprising a casing, a signal wheel and mechanism rotating it located within the body of the casing, laterally ranging contacts on the casing cover and independent of the signal wheel, a contact lever also on the cover and movable bodily and laterally thereon and along said contacts and electrical connections to said contacts.

503,710. CONTACT FOR CONDUIT ELECTRIC RAILWAYS; Adolf Worner, Budapest, Austria-Hungary. Application filed May 18, 1893. The combination, in a subway contact, of a supporting frame, electrical conductors having free vertical movement in said frame, and guards preventing injury to the conductors at the roadway slot.

503,712. WIRE-COUPLING; William E. Banta, Springfield, O. Application filed October 5, 1892. In a wire coupling, the combination with overlapping ends of a line wire, of a gripping connector encircling and mounted on said overlapping ends, and divided into connected portions, and means to swell the size of the joint at the place between said portions of the connector, and effect the gripping engagement thereof.

503,718. BLOCK-SIGNAL INDICATING MECHANISM; Johann Heinrich Frischen, Berlin, Germany. Application filed May 1, 1893. An electric block signal apparatus for railways, comprising sets of switch levers at two stations, each set having primary and secondary duplex contact devices consisting of four levers coupled in pairs by two rods, contacts to which the primary and secondary duplex levers are adapted, an

electromagnet at each station having an armature adapted to catch the actuated primary duplex lever thereof, a signaling device at each station, an electromagnet having an armature controlling said signaling device, a battery at each station and wires connecting the two stations, their batteries, electromagnets, contacts and switch levers.

503,727. ELECTRO-MAGNETIC SAFETY-COUPLING; Ernst Richter and Carl Hoffmann, Berlin, Germany, Assignors to Siemens & Halske, of same place. Application filed Jan. 14, 1893. An electro-magnetic coupling and brake comprising a driving or power shaft, a shaft to be driven, a portion carrying a coil mounted on the driving shaft, a portion mounted on the shaft to be driven, a stationary portion carrying a coil, a source of electricity, and means for transmitting a current of electricity in either direction through either the coil on the driving or on the stationary portion of said device.

503,749. SECTION INSULATOR; Louis McCarthy, Boston, Mass. Application filed April 15, 1893. A section insulator for electric conductors comprising metallic portions to which the proximate ends of the conductor sections are secured, a tie-piece of non-conducting material for the passage of the trolley wheel, an insulated connection extending between the metallic end portions, said insulated connection comprising a series of insulators each of which consists of a metallic case, a connecting piece placed therein and having a screw-threaded socket and insulating material whereby said connecting piece is insulated from said case and said cap, the insulators being connected together by having the shank of one inserted into the socket of the next inner one.

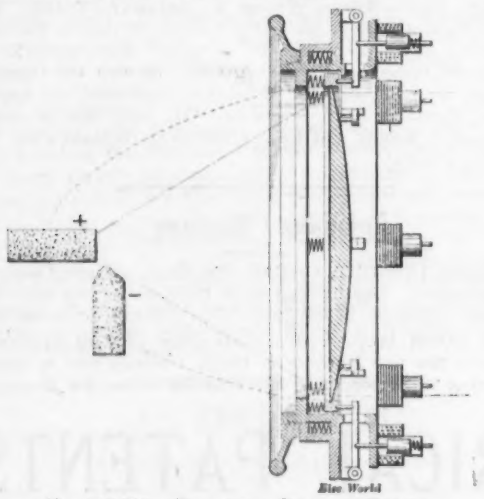
503,750. REGULATING APPARATUS FOR ELECTRIC MOTORS; Charles H. Richardson, Philadelphia, Pa. Application filed April 27, 1893. The combination of the motor, the generator mechanically driven thereby, switch mechanism in the generator circuit, and the switch lever by which said mechanisms are simultaneously operated.

503,770. INCANDESCENT ELECTRIC LAMP; William Emery Nickerson, Cambridge, Mass. Application filed July 3, 1893. In an incandescent electric lamp, in which the neck of the lamp bulb is closed airtight by a fusible cement, a section of fusible metal in the circuit, whereby the electric current is cut off by the melting of said metal if the lamp becomes overheated.

503,775. ELECTRICAL CONTACT DEVICE; James K. Pritchard, Providence, R. I. Application filed March 20, 1893. In an electric contact device, peripherally grooved trolley wheels mounted in pairs on pivoted plates electrically connected with one arm of a circuit, and springs for exerting a strain on the plates.

503,788. LIGHTNING ARRESTER; William Le Roy Emmet, Chicago, Ill. Application filed July 11, 1892. As an improvement in lightning arresters, the combination of a single pair of terminals for line and ground, a single pair of contact flanges adapted to engage the same, two or more arresters between and adapted to electrically connect the contact flanges.

503,789. INSULATOR FOR ELECTRIC WIRES; William D. Trimble, Hanesville, Md. Application filed April 14, 1893. In an insulator-supporting device for electric wires, the combination of the socket, interiorly circular in cross-section, having a longitudinal slot and a slot transverse to said longitudinal slot and extending partly around the socket; and an insulator exteriorly round in cross-section fitting within the socket and adapted to turn therein and having a boss fitting within the transverse slot of the socket.



No. 503,632.—ELECTRIC SEARCH LIGHT.

503,799. ELECTRIC ARC LAMP; Walter W. Millard, Fenton, Mich. Application filed April 3, 1893. In an electric arc lamp, the combination of the movable carbon rod, a cross head thereon, a detachable connection for the rod and cross head and two carbon sockets on said cross head.

503,805. ELECTRIC METER; Anthony Reckenzaun, London, England. Application filed November 26, 1892. In an electric meter, having a registering device and an automatic make and break device, an oscillatory bar or beam suspended centrally or substantially centrally and operating to actuate said make and break device in its oscillations, a non-magnetically acting device for imparting an impulse to said bar or beam, and mechanism influenced by the current passing through the meter to operate said registering device.

503,807. ELECTRICAL CUT-OUT; Lewis B. Matson, Elmira, N. Y. Application filed Jan. 19, 1893. The combination of a main circuit, longitudinal and separable arms therein formed of spring metal which normally engage each other at their free ends, a loop, posts to which the ends of the same are connected, and a means for separating the said springs and moving them in contact with the loop posts.

503,811. ELECTRIC BELT; Adolph Stephenson and Jonas Backstrom, Stromsburg, Neb. Application filed Feb. 23, 1893. In an electric belt the combination of elastic webbing, a textile lining, such as flannel, and a series of copper and zinc studs inserted in the lining with their larger portions overlapping between the lining and the elastic web, with the convex ends of the studs projecting inwardly through the lining in position to contact with the surface of the body of the wearer.

503,873. ELECTRICAL CONDUIT FOR BUILDINGS; James Jerome Powers and Robert Van Buren, Brooklyn, N. Y. Application filed April 27, 1893. In an electrical conduit for buildings, a series of baked clay sections apertured longitudinally and provided with collars around the apertures at one end of the section, and recesses around the apertures at the opposite end of the section for receiving the collars of the adjacent section, the said sections being made of a suitable proportion for laying along with the brick in a brick wall, and glazed interiorly, and left unglazed on the exterior, with a rough surface to adapt it to receive and hold mortar.

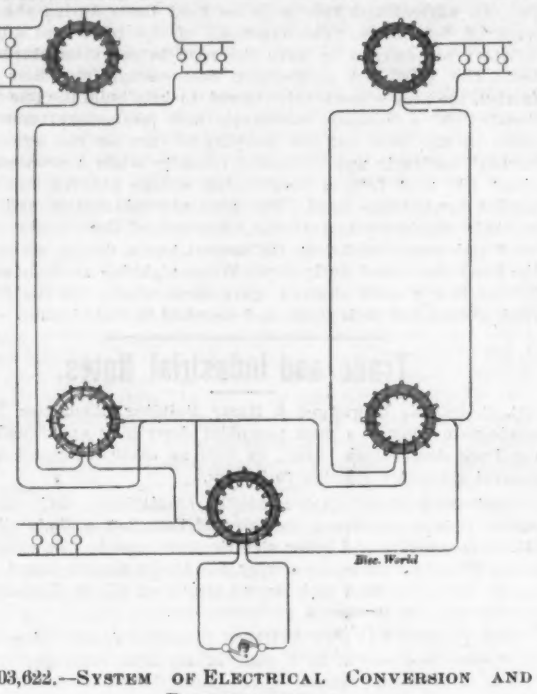
503,912. COMBINED GAS AND ELECTRIC LIGHT FIXTURE; James A. O'Neill, Boston, Mass. Application filed Oct. 29, 1892. A coupling for gas and electric light fixtures comprising a casting provided with a gas passage and electric circuit wires, combined with a movable gas cock to co-operate with said passage, and a circuit closer carried by and movable independent of said cock, whereby the gas and the electric current are regulated independently.

UNITED STATES PATENTS ISSUED AUG. 29, 1893.

(IN CHARGE OF W. A. ROSENBAUM, 177 TIMES BLDG., N. Y.)

503,981. SIGNALING APPARATUS FOR RAILWAYS; John Ore, London, England. Application filed Dec. 6, 1892. The combination of a commutator or pole changer with the relays and semaphores upon the train and on the cabin operated by batteries, which transmit through a conductor a constant current of varying direction.

504,002. FIRE SIGNALING OR ALARM MECHANISM; Louis J. Tirard, Caen, France. Application filed June 24, 1893. In an alarm mechanism of the class described, the combination with a vessel adapted to receive a liquid, a tube communicating therewith and adapted to contain a liquid to be discharged into said vessel, a second tube communicating at one end with the first mentioned tube and having its opposite end closed, of a pivoted arm or lever arranged in proximity to the closed end of the tube and adapted to be normally supported in an elevated position and to be automatically released from its support when the temperature exceeds a predetermined degree, said arm or lever being adapted when released to place the closed end of the described second tube in communication with the outer air.



No. 503,622.—SYSTEM OF ELECTRICAL CONVERSION AND DISTRIBUTION.

504,042. ELECTRIC CIRCUIT FOR CONTROLLING TRAINS; Frank E. Kinsman, Plainfield, N. J. Application filed Jan. 11, 1892. In an apparatus for controlling the movement of railway vehicles, the combination with an electromagnet connected to the opposite rails of a section of track, of a battery or other generator of electricity connected to the opposite rails of the said section, and an auxiliary independent conductor extending from said generator along said section and forming a circuit closed through wheels and axles of a vehicle on said section and independent to a greater or less extent of the rails for a greater or less portion of the section.

504,059. INSULATOR; Geo. W. Blackburn, Palmyra, N. J. Application filed Aug. 30, 1892. In an insulator for electric conductors, a ball-shaped clamping lever, a block of insulating material having a right lined groove therein adapted to receive a conducting line wire and aperture adapted to receive the pivotal ends of said ball-shaped lever in combination with a single clamp adapted to hook over the conductor on each side of the block and provided with pivotal ends engaged in eyes in said clamping levers, constructed and arranged to operate.

504,087. ELECTRIC BOWLING ALLEY; Pehr Prisco Nelson, New York, N. Y. Application filed Sept. 21, 1892. The combination of an elevator for balls, an electric motor for operating said elevator, a chute to deliver balls to the elevator, a receptacle to receive balls from the elevator, a circuit closer operated by a ball as it passes from the chute to the elevator and means to open said circuit closer operated by the ball as it passes from the elevator to the receptacle.

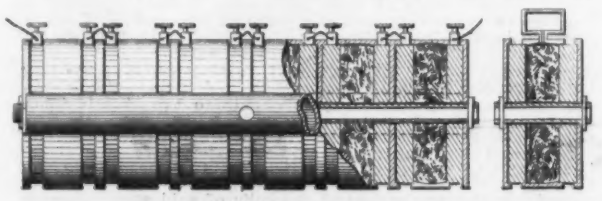
504,095. ELECTRIC CLOCK; Emil Schweizer, Sumiswald, Switzerland. Application filed July 16, 1892. In an electric clock, the combination with an electromagnet, its armature mounted on the shorter arm of the armature lever, the said lever having its longer arm weighted, the wheels which operate the clock hands mechanism intermediate the weighted arm of the armature lever and said clock wheels, whereby the descent of said lever rotates said wheels, and a circuit breaker and closer, of the escapement, the verge wheel bearing a pawl, the scroll disc, loosely mounted concentric with the wheel and engaged by the pawl, the pinion, connected to the disc, and the rack on the armature lever in gear with said pinion.

504,103. SYSTEM OF TELEPHONIC INTERCOMMUNICATION; Frank C. Colvin, New York, N. Y. Application filed Feb. 6, 1893. In a telephone system the combination of the main circuit and a portable telephone having one of its terminals provided with a metallic extension mounted on the instrument, and the other in electrical connection with a metallic support upon which the telephone may be hung, the two terminals leading to opposite sides of the circuit, whereby, when the telephone rests on the support, it is short-circuited, but when removed therefrom the short circuit is open.

504,104. ELECTRIC CONDUIT FOR RAILWAYS; Joseph I. Conklin, Brooklyn, N. Y. Application filed May 2, 1892. In an electrical conduit the combination with the casing having a central longitudinal opening, of the insulating material, the main conductor embedded therein, with a head projecting up above the surface thereof, the elastic non-conducting strips at each side of said head resting on said insulating material, and the secondary conductors resting on said strips.

504,105. MANUFACTURE OF CARBON RODS FOR ELECTRIC ARC LAMPS; Ehrenfried Corleis and Hermann Reinsch, Essen, Germany, Assignors to the firm of Fried. Krupp, of same place. Application filed April 26, 1893. An arc light carbon impregnated with tungstic acid, or a salt of this acid.

504,113. ELECTRIC RAILWAY TROLLEY; Alexander Palmros, Lynn, Mass., Assignor of one-half to Varna J. Pierce, Hudson, Me. Application filed Sept. 1, 1892. The herein described trolley device consisting of a trolley wheel having its spindle loosely journaled in a bearing on the trolley pole, combined with a double-acting single spring arranged on said spindle and having its ends pressing against the spindle bearing.



No. 504,130.—ELECTRIC BATTERY.

504,123. CIRCUIT SWITCH; Charles E. Dey, Denver, Colo. Application filed Dec. 13, 1892. In a circuit switch the combination with a suitable casing of three contacts secured to the bottom plate, to which contacts the circuit wires respectively lead, a bar pivoted to one of these contacts and adapted to alternately engage the other contacts, shouldered push buttons having their inner reduced extremities surrounded by coil springs engaging the shoulders of the button at one extremity and the bar at the opposite extremity, said shoulder engaging the inner surface of the top plate of the casing, while the upper through apertures formed in said plate, the buttons affording means for shifting the pivoted bar from one contact to the other.

504,130. ELECTRIC BATTERY; Hosea W. Libbey, Boston, Mass. Application filed Sept. 15, 1892. In an electric battery a cell consisting of two outer discs or plates of insulating material, a central ring in insulating material, two discs or plates forming the positive and negative elements, an absorbent material between said discs or plates, and means for supplying exciting fluid to said absorbent material. (See illustration.)

504,148. PUSH BUTTON; William H. Berrigan, Jr., New York, N. Y. Application filed April 7, 1892. A shell for push buttons, consisting of a body, with opening therein, a lip with opening therein, and a tongue with the opening therein.

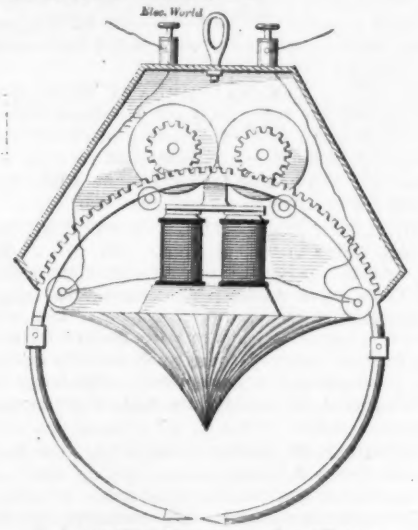
504,160. RHEOSTAT; Albert B. Herrick, Schenectady, N. Y., Assignor to the General Electric Company, Boston, Mass. Application filed July 22, 1892. A resistance switch for an electromotor comprising contact segments with interposed resistances, and a contact arm traversing said segments, relatively arranged and constructed to progressively decrease the resistance by a movement in one direction, and by a further movement in the same direction to first suddenly introduce a high resistance and afterward break the circuit.

504,177. BRUSH FOR DYNAMOS OR ELECTRIC MOTORS; Frederick H. Sandherr, St. Louis, Mo. Application filed Jan. 7, 1893. In a rolling contact, the combination of a stationary stud, a pair of collars attached to the stud, a spring-pressed ring surrounding the stud, a wheel rim provided with a web received between the collars, and a series of rollers inserted between the web and the ring.

504,196. ELECTRIC INDICATOR; Jay L. Bradley, St. Louis, Mo. Application filed Feb. 4, 1893. In an electric indicator, the combination of a continuous wire passed back and forth through the different stories of a building, circuit breakers located in said wire, a bell in electric circuit at the place where the signal is to be given, a magnet in circuit with said continuous wire, and an armature having a pawl and ratchet connection with said indicator.

504,200. ART OF CONCENTRATING MAGNETIC IRON ORES; Gurdon Conkling, Glens Falls, N. Y. Application filed Sept. 30, 1891. The herein described process of concentrating magnetic iron ore, which consists in first comminuting the ore in the presence of water, then exposing the comminuted ore while being carried in a stream of water to the action of magnets and continuously removing the magnetic particles which have been attracted by the magnets from the magnetic field while the non-magnetic particles are carried away by the water, then drying the magnetic particles and finally exposing the dried particles to the action of magnets.

504,201. ART OF CONCENTRATING MAGNETIC IRON ORE; G. Conkling, Glen Falls, N. Y. Application filed Jan. 16, 1893. The process of concentrating iron ore, which consists in first coarsely crushing the ore in a wet state, then exposing the crushed mass while wet to the action of magnets, then recrushing the concentrate thus obtained while wet, then drying the recrushed mass and finally exposing the dry mass to the action of the magnets.



No. 504,277.—ELECTRIC ARC LAMP.

504,216. REGULATOR FOR DYNAMO-ELECTRIC MACHINES; John C. Henry, New York City. Application filed April 20, 1892. The combination of a power transmitting gearing, consisting of a gear and pinion held to intermesh, but one free to rotate about the other, belt and pulley connected to be adapted to drive one of said members, and a regulating device connected to the free member of the gearing.

504,249. MULTIPLE SWITCHBOARD KEYBOARD APPARATUS; Chas. E. Scribner, Chicago, Ill. Application filed Dec. 6, 1887. A telephone line connected with one point of a terminal plug and a telephone connected with another point of the same plug, and a connecting device for closing the circuit between the two points of the plug to connect said line with the telephone.

504,250. TELEPHONE EXCHANGE TESTING APPARATUS; Chas. E. Scribner, Chicago, Ill. Application filed June 1, 1889. The combination with two or more lines upon two or more switchboards, each line being connected with a springjack upon each board, of connecting plugs and cords connected with a listening key, the operator's telephone outfit, a test plug and a cord connected with the operator's telephone outfit at a point between the test battery and telephone outfit, whereby a test may be made with the telephone outfit through the test battery or independent of it as may be desired.

504,251. VIBRATING CIRCUIT-BREAKER AND RETARDATION COIL FOR TEST SYSTEMS; Chas. E. Scribner, Chicago, Ill. Application filed March 4, 1892. A retarding coil having a central cylindrical core of iron, a coil of wire surrounding the central core, a tube of iron surrounding the coil, and of the same length as the central core, and a plate of iron uniting the central core and the external tube at one end, and an armature pivoted to swing in the direction of the axis of the coil adapted to close against the presented ends of the core and tube, a spring to hold the armature normally away from the ends of the core and tube and against a fixed insulated stop.

504,255. ELECTRIC RAILWAY TROLLEY; F. J. Sprague and P. F. O'Shaughnessy, New York City. Application filed Jan. 19, 1889. The combination with an electric railway car of a contact device for making underneath contact with an overhead conductor and free to move both laterally and longitudinally of the car, and a spring coiled around a vertical axis for supporting said contact device.

504,271. ELECTRIC ARC LAMP; Rudolph M. Hunter, Philadelphia, Pa. Application filed June 9, 1893. In an arc lamp, the combination of a feeding rod carrying at the lower part two carbon holders, an electric regulator for feeding the said feeding rod, means for lifting the said feeding rod and its holders after the same have been once fully lowered, a carbon holder for each of the lower carbons, an automatic device for bringing the lower carbon holder of the second pair of carbons into alignment with its upper carbon holder after the feeding rod has been lifted upon the consumption of the first pair of carbons.

504,276. CROSSING FOR ELECTRIC RAILWAYS; J. Nelson, St. Louis, Mo., and Thomas C. White. Application filed May 18, 1893. An insulating trolley crossing for intersecting electric wires constructed substantially as herein described with a seat for the lower wire, an insulating seat for the upper wire, slotted for the passage for the lower wire, and means for confining the upper wire in its seat.

504,277. ELECTRIC ARC LAMP; Wm. A. Phillips, U. S. Army, Assignor of one-half to Thomas J. Porter, Miles City, Mont. Application filed June 3, 1893. In an electric arc lamp, the combination of the circular carbon holders and wheels intergeared therewith, an electromagnet, and an armature adapted to engage said wheels as a brake and released therefrom by the action of said electromagnet. (See illustration.)

Copies of the specifications and drawings complete of any patent mentioned in this record—or of any other patent issued since 1876—can be had for 25 cents. Give date and number of patent desired and address The W. J. Johnston Co., Ltd., Times Building, N. Y.